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United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
South Dakota
Agricultural
Experiment
Station

Soil Survey of Meade County, Northern Part, South Dakota

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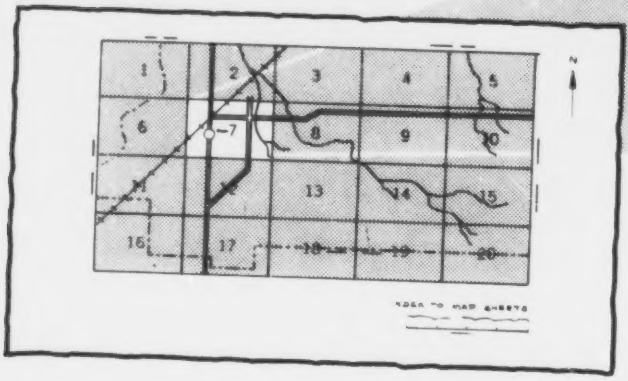
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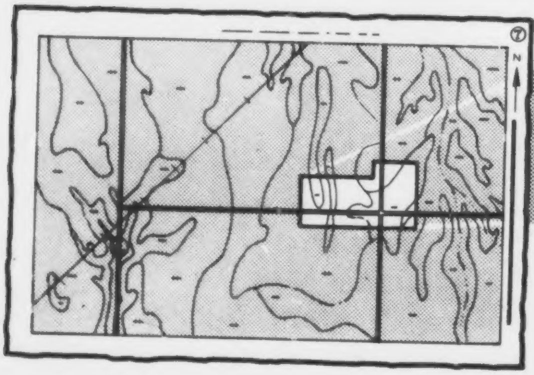

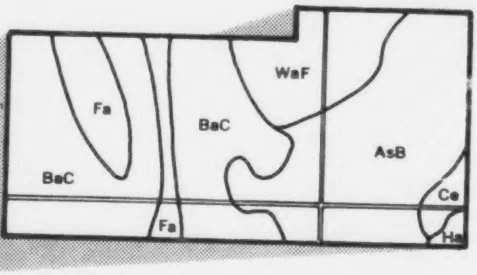
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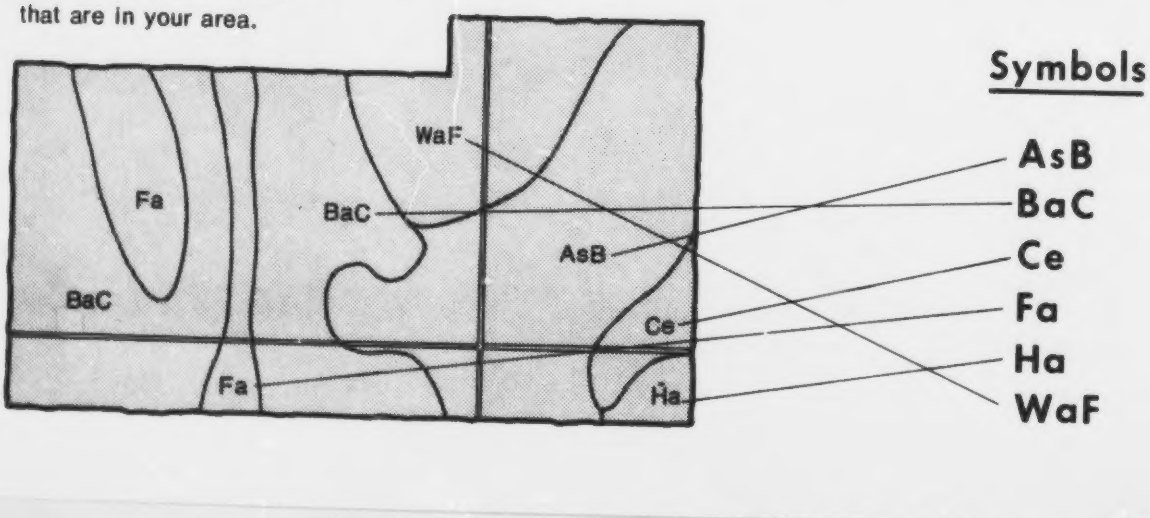
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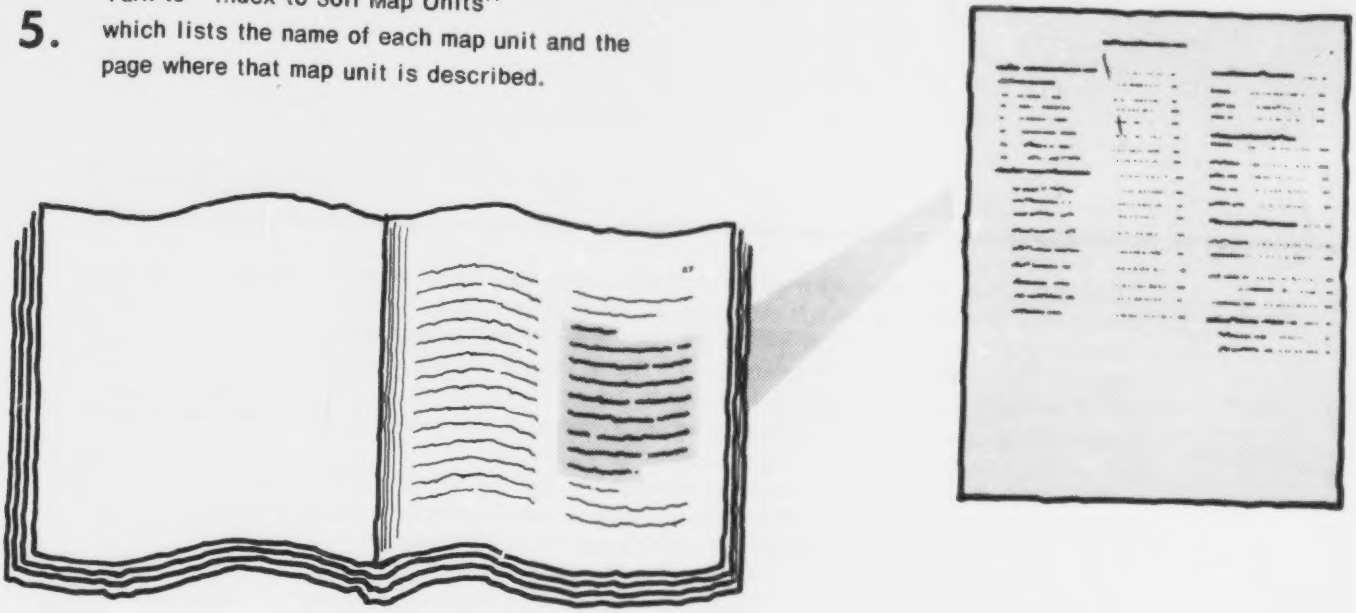
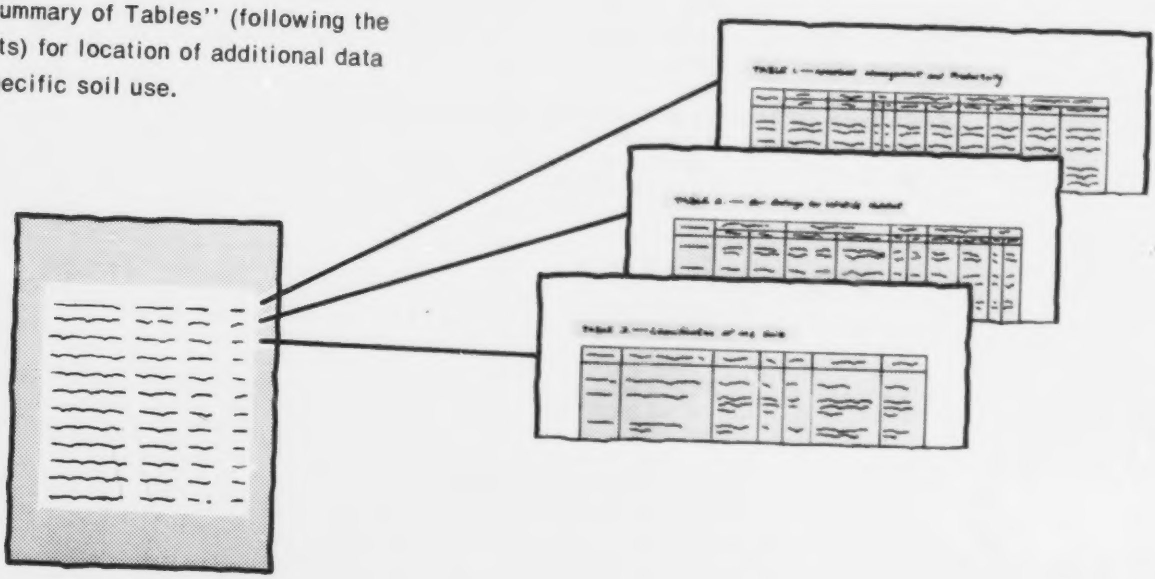
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Tri-County Conservation District. Financial assistance was furnished by the South Dakota Department of Revenue, the Old West Regional Commission, and the Meade County Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: An area of Cabbart loam, 9 to 40 percent slopes, used as range.

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Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

R. D. Swenson

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Soil Survey of Meade County, Northern Part, South Dakota

By Arvid C. Meland, Soil Conservation Service

Soils surveyed by Arvid C. Meland, Allen A. Faulkner, and
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United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the South Dakota Agricultural Experiment Station

MEADE COUNTY, NORTHERN PART, is in the northwestern part of South Dakota (fig. 1). It has a total of 1,075,397 acres, which includes about 3,747 acres of water. Sturgis is the county seat and principal town in Meade County. It is in the southern part of the county, outside the survey area. Faith, in the extreme northeast part of the survey area, is the principal trade center. Other communities are Howes, Marcus, Maurine, Mud Butte, Opal, Plainview, Red Owl, Stoneville, and White Owl.

General Nature of the Survey Area

This section gives general information concerning the county. It describes climate; physiography, relief, and drainage; settlement; ranching; and natural resources.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The survey area is usually quite warm in summer. Hot spells frequently occur, and cool days occasionally occur. The survey area is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls during the warm period, and rainfall is heaviest late in spring and early in summer. Snowfall is normally not too heavy, and it is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Faith, South Dakota, in the period 1951 to 1979. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

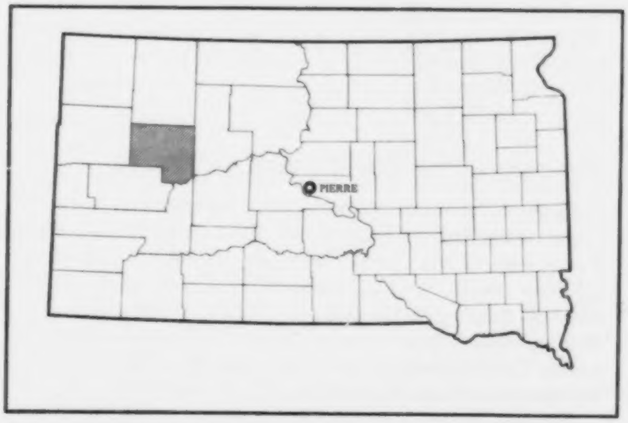

Figure 1.—Location of Meade County, northern part, in South Dakota.

In winter the average temperature is 19 degrees F, and the average daily minimum temperature is 8 degrees. The lowest temperature on record, which occurred at Faith on January 28, 1972, is -34 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Faith on July 29, 1951, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 16 inches. Of this, nearly 13 inches, or 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 3.35 inches at Faith, on May 21, 1962. Thunderstorms occur on about 42 days each year, and most occur in summer. Hail falls in scattered small areas during some of these storms.

The average seasonal snowfall is 34 inches. The greatest snow depth at any one time during the period of record was 25 inches. On the average, 45 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

Most of the northern part of the survey area is on the Cretaceous Table Lands and in the southern part of the Pierre Hills of the Great Plains physiographic province (*7*). The survey area is characterized by a nearly level to strongly sloping landscape, except for areas near drainageways, which generally are moderately steep or steep. On the Cretaceous Table Lands, a few prominent buttes rise above the surrounding landscape.

The southern part of the survey area is drained by the Cheyenne and Belle Fourche Rivers. Most of the northern part is drained by Sulphur and Red Owl Creeks, which combine to form Cherry Creek. The Cheyenne and Belle Fourche Rivers are perennial streams. The rest of the streams carry only a little water during most periods, except for the spring and just after heavy rainfall.

Land elevation ranges from 1,890 feet above sea level along the Cheyenne River in the southeastern part of the survey area to 3,242 feet on Chalk Butte.

Settlement

Meade County was named after George G. Meade, a general in the Union Army during the Civil War. It was established in 1889 by an act of the Dakota Territory Legislature. The original county was much smaller. In 1897, the former counties of Scobey and Delano were added and the current boundaries were established (*5*).

Faith is the only town in the survey area. It had a population of 576 in 1980 (*12*). The remainder of the survey area is very sparsely settled.

South Dakota State Highways 34 and 73 and United States Highway 212 are the main thoroughfares. Many rural areas are served by poor roads and by trails. From 1910 until 1979, a railroad served Faith and provided a shipping point for the northern part of the survey area.

Ranching

Ranching is the principal enterprise in the survey area. Beef cattle and sheep are the main types of livestock. Most of the farm income is derived from the sale of livestock and livestock products. Many of the crops are used as feed for livestock. Most of the small grain is sold as a cash crop.

About 86 percent of the acreage is range, and about 14 percent is used for cultivated crops or for tame pasture and hay (*3*). Alfalfa and wheat, both winter and spring, are the main crops. Oats and grain sorghum also are grown.

The survey area is part of the Tri-County Conservation District, which was organized in October 1937 as the first conservation district in South Dakota. The district has been instrumental in planting grasses and trees to help control erosion. The trees also provide protection for farmsteads and for wildlife.

Natural Resources

Soil is the most important natural resource in the survey area. It provides a medium for crops and for the grass grazed by livestock. Other natural resources are water, sand and gravel, and wildlife.

The principal source of water for livestock is stock water impoundments. Artesian wells that extend into the Dakota Formation provide additional water; however, the quality is poor (*4*). The Cheyenne River is a source of water for livestock, wildlife, and irrigation. Shallow wells on flood plains, on terraces, and in areas of the Bullock-Parchin association also provide a limited supply of water.

Deer, antelope, and grouse are the chief wildlife resources in the survey area. Coyotes are the chief predators.

The deposits of sand and gravel are mainly on scattered terrace scarps in the southern part of the survey area. They range from a few inches to many feet in thickness. Because of an excessive amount of fine rock fragments, such as shale and chalk, the sand and gravel are unsuitable as concrete aggregate or as construction material. They are suitable, however, as subgrade material for roads and as bituminous aggregate.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 11 associations on the general soil map of the survey area have been grouped for broad interpretive purposes. They are described on the pages that follow. The names of the associations do not coincide exactly with those on the general soil maps in the published surveys of Butte and Perkins Counties and Meade County, Southern Part, which are adjacent to this survey area. Differences are the result of variations in the design and composition of map units or changes and refinements in series concepts.

Soil Descriptions

Nearly Level, Loamy and Silty Soils on Flood Plains

These soils make up about 1 percent of the survey area. About 60 percent of the acreage is range. Alfalfa and small grain are the main crops. Conserving moisture and controlling wind erosion are the main management concerns.

1. Lohmiller-Glenberg Association

Deep, well drained, nearly level, silty and loamy soils on flood plains

This association is on flood plains. It makes up about 1 percent of the survey area. It is about 60 percent Lohmiller soils, 15 percent Glenberg soils, and 25 percent minor soils.

The silty Lohmiller soils are on the high parts of the flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is grayish brown, calcareous silty clay loam. The underlying material is grayish brown and light brownish gray, stratified, calcareous clay loam, silty clay loam, clay, and sandy loam.

The loamy Glenberg soils are on the low parts of the flood plains adjacent to the streams. Slopes range from 0 to 2 percent. Typically, the surface layer is grayish brown, calcareous fine sandy loam. The underlying material is grayish brown, stratified, calcareous fine sandy loam and loamy fine sand.

Minor in this association are the sandy Bankard soils adjacent to the streams; the clayey Kyle and Swanboy soils on foot slopes; and the stratified, clayey Stetter soils in positions on the landscape similar to those of the Lohmiller soils.

About 60 percent of this association is range. Some areas are used as cropland. Alfalfa and small grain are the main crops. They are grown mainly on the larger tracts of the Lohmiller soils. Conserving moisture and controlling wind erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and both openland and rangeland wildlife habitat. In some areas the meandering stream channels are a limitation. Trees and shrubs near the channels and in some areas of the Glenberg soils provide excellent cover for wildlife and livestock.

Nearly Level to Steep, Clayey Soils on Foot Slopes and Uplands

These soils dominantly are gently sloping to steep but are nearly level in places. They make up about 21 percent of the survey area. About 85 percent of the acreage is range. Alfalfa and small grain are the main crops. Controlling erosion is the main management concern.

2. Samsil Association

Shallow, well drained, moderately sloping to steep, clayey soils on uplands

This association is on breaks along the major streams in the southeastern part of the survey area. The landscape is characterized by steep slopes and deeply entrenched drainageways. The soils generally are moderately steep and steep but are moderately sloping on some side slopes. The drainage pattern is well defined.

This association makes up about 9 percent of the survey area. It is about 72 percent Samsil soils and 28 percent minor soils (fig. 2).

The Samsil soils are on side slopes and ridges. Slopes range from 6 to 40 percent. Typically, the surface layer is grayish brown, calcareous clay. The next layer also is grayish brown, calcareous clay. The underlying material is grayish brown shaly clay. Light brownish gray shale is at a depth of about 13 inches.

Minor in this association are Hisle, Kyle, Pierre, Stetter, and Swanboy soils and Rock outcrop. The sodium affected Hisle soils are on the lower side slopes. The deep Kyle and Swanboy soils and the moderately deep Pierre soils are on the less sloping parts of the landscape. The stratified Stetter soils are on narrow flood plains. The Rock outcrop is in scattered areas on some steep slopes.

Nearly all of this association supports native grasses and is used for range. Controlling erosion is the main concern of management. The association is suited to range and to rangeland wildlife habitat. It generally is unsuited to cultivated crops and to tame pasture and hay because of the slope and the shallow depth to shale.

3. Lawther-Abor Association

Deep and moderately deep, well drained, gently sloping and moderately sloping, clayey soils on uplands

This association is on uplands in the eastern part of the survey area. Slopes mainly are gently sloping, but some areas are moderately sloping. In most areas the drainage pattern is well defined, but it is poorly defined in some nearly level areas.

This association makes up about 8 percent of the survey area. It is about 40 percent Lawther soils, 30 percent Abor soils, and 30 percent minor soils.

The deep Lawther soils are on the lower side slopes. Slopes range from 2 to 6 percent. Typically, the surface layer is dark grayish brown silty clay. The subsoil is

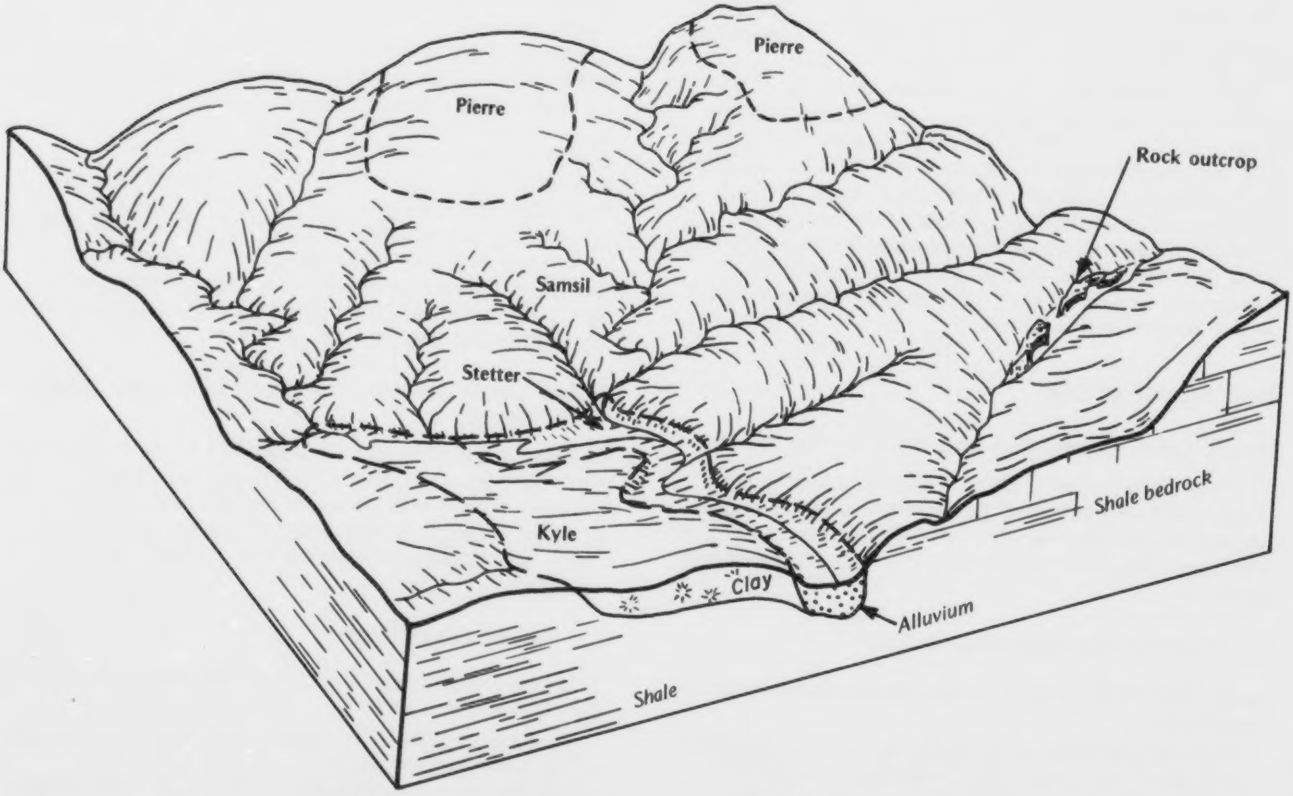

Figure 2.—Pattern of soils and parent material in the Samsil association.

grayish brown silty clay and clay. The underlying material is light brownish gray, calcareous silty clay.

The moderately deep Abor soils are on side slopes. Slopes range from 2 to 9 percent. Typically, the surface layer is grayish brown, calcareous silty clay. The subsoil is light brownish gray silty clay. The underlying material is light brownish gray silty clay. Light yellowish brown shale is at a depth of about 27 inches.

Minor in this association are Absher, Delridge, Eapa, and Gerdrum soils. The Absher soils have visible salts within a depth of 15 inches. They are in smooth areas and on foot slopes. The moderately deep, loamy Delridge soils are on ridges. The deep, loamy Eapa soils are in positions on the landscape similar to those of the Lawther soils. The loamy, sodium affected Gerdrum soils are on the less sloping parts of the landscape.

About 70 percent of this association is range. Some areas are used as cropland. Conserving moisture, controlling erosion, and improving tilth are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and both openland and rangeland wildlife habitat.

4. Lismas-Pierre-Swanboy Association

Shallow to deep, well drained, nearly level to steep, clayey soils on uplands and foot slopes

This association is on uplands dominantly in the western part of the survey area. The landscape is characterized by moderately steep slopes and entrenched drainageways. The soils generally are moderately sloping to steep but are nearly level to moderately sloping on the foot slopes. The drainage pattern is well defined.

This association makes up about 4 percent of the survey area. It is about 27 percent Lismas soils, 27 percent Pierre soils, 26 percent Swanboy soils, and 20 percent minor soils.

The shallow Lismas soils are on ridges and the upper side slopes. Slopes range from 6 to 40 percent. Typically, the surface layer is light olive gray clay. The underlying material is light olive gray clay and shaly clay. Light olive gray shale is at a depth of about 11 inches.

The moderately deep Pierre soils are on the lower side slopes. Slopes range from 2 to 30 percent. Typically, the surface layer is grayish brown clay. The subsoil is olive gray, calcareous clay. The underlying material is olive gray, calcareous shaly clay. Gray shale is at a depth of about 28 inches.

The deep Swanboy soils are on foot slopes. Slopes range from 0 to 2 percent. Typically, the surface layer is light brownish gray clay. The subsoil is light brownish gray and olive gray clay. The underlying material is olive gray clay. Visible gypsum crystals and other salts are throughout the subsoil and underlying material.

Minor in this association are Hisle, Kyle, Stetter, and Winler soils. The sodium affected Hisle soils are in the nearly level areas. The deep Kyle soils are not so dense as the Swanboy soils. They are on the lower side slopes. The stratified Stetter soils are on narrow flood plains. The moderately deep Winler soils are not so dense as the Pierre soils. They are in the moderately sloping areas.

Nearly all of this association is used for range. Controlling erosion is the main concern of management. The association is suited to range and to rangeland wildlife habitat. It generally is unsuited to cultivated crops and to tame pasture and hay because of the slope, the shallow depth to shale, and extremely poor tilth in the Swanboy soils.

Nearly Level to Steep, Loamy and Silty Soils on Uplands and Terraces

These soils dominantly are nearly level to strongly sloping but are moderately steep and steep in places. They make up about 54 percent of the survey area. About 60 percent of the acreage is range. Alfalfa and small grain are the main crops. Conserving moisture and controlling erosion are the main management concerns.

5. Nunn-Satanta Association

Deep, well drained, nearly level and gently sloping, loamy soils on terraces

This association is on terraces adjacent to the breaks along the Cheyenne River. Slopes are nearly level and gently sloping. In most areas the drainage pattern is well defined.

This association makes up about 2 percent of the survey area. It is about 60 percent Nunn soils, 35 percent Satanta soils, and 5 percent minor soils.

Nunn soils have a slope of 0 to 6 percent. Typically, the surface layer is dark grayish brown clay loam. The subsoil is dark grayish brown and grayish brown clay and clay loam. It is calcareous in the lower part. The underlying material is grayish brown, calcareous clay loam.

Satanta soils have a slope of 0 to 6 percent. Typically, the surface soil is grayish brown and brown loam. The subsoil is brown, light olive brown, and grayish brown clay loam and loam. It is calcareous in the lower part. The underlying material is grayish brown, calcareous clay loam.

Minor in this association are the sodium affected Gerdrum soils in smooth areas and the moderately deep, clayey Pierre soils on the lower side slopes along drainageways.

About 70 percent of this association is cropland. Alfalfa and small grain are the main crops. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and both openland and rangeland wildlife habitat.

6. Assinniboine-Blackhall-Twilight Association

Deep to shallow, well drained, gently sloping to steep, loamy soils on uplands

This association is on uplands characterized by smooth, gently sloping areas and deeply dissected, more sloping areas. In most areas the drainage pattern is well defined.

This association makes up about 28 percent of the survey area. It is about 23 percent Assinniboine soils, 16 percent Blackhall soils, 14 percent Twilight soils, and 47 percent minor soils (fig. 3).

The deep Assinniboine soils generally are on the low parts of the landscape. Slopes range from 2 to 9 percent. Typically, the surface layer is brown fine sandy loam. The subsoil is brown sandy clay loam and pale brown, calcareous fine sandy loam. The underlying material is pale brown, calcareous fine sandy loam.

The shallow Blackhall soils generally are on ridges, on steep side slopes, and in rimrock areas. Slopes range from 9 to 40 percent. Typically, the surface layer is grayish brown, calcareous fine sandy loam. The underlying material is olive, calcareous fine sandy loam. Pale olive, soft sandstone is at a depth of about 11 inches.

The moderately deep Twilight soils are on the high parts of the landscape. Slopes range from 4 to 15 percent. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is brown fine sandy loam. The underlying material is light gray, calcareous fine sandy loam. Light gray, soft sandstone is at a depth of about 36 inches.

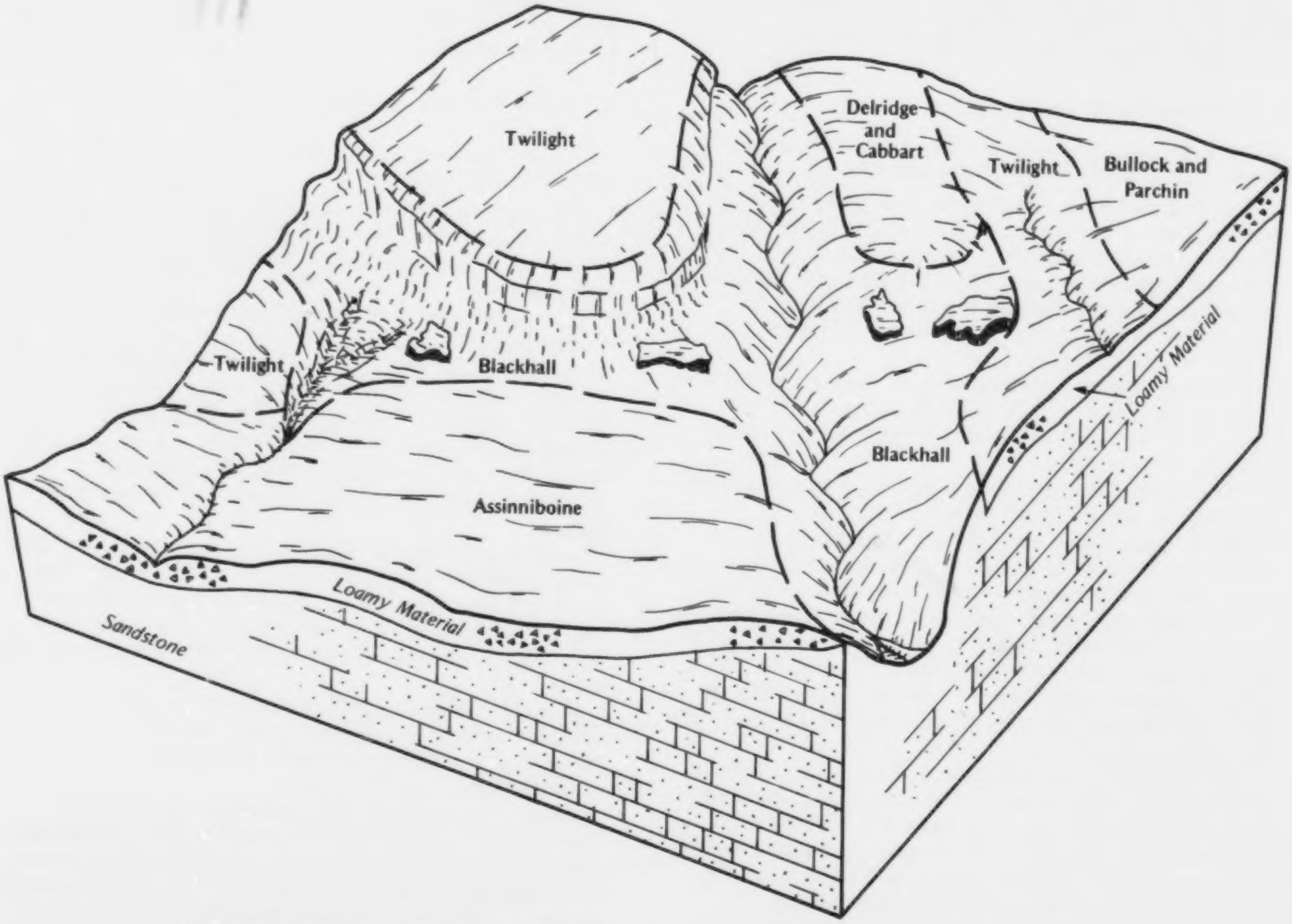

Figure 3.—Pattern of soils and parent material in the Assinniboine-Blackhall-Twilight association.

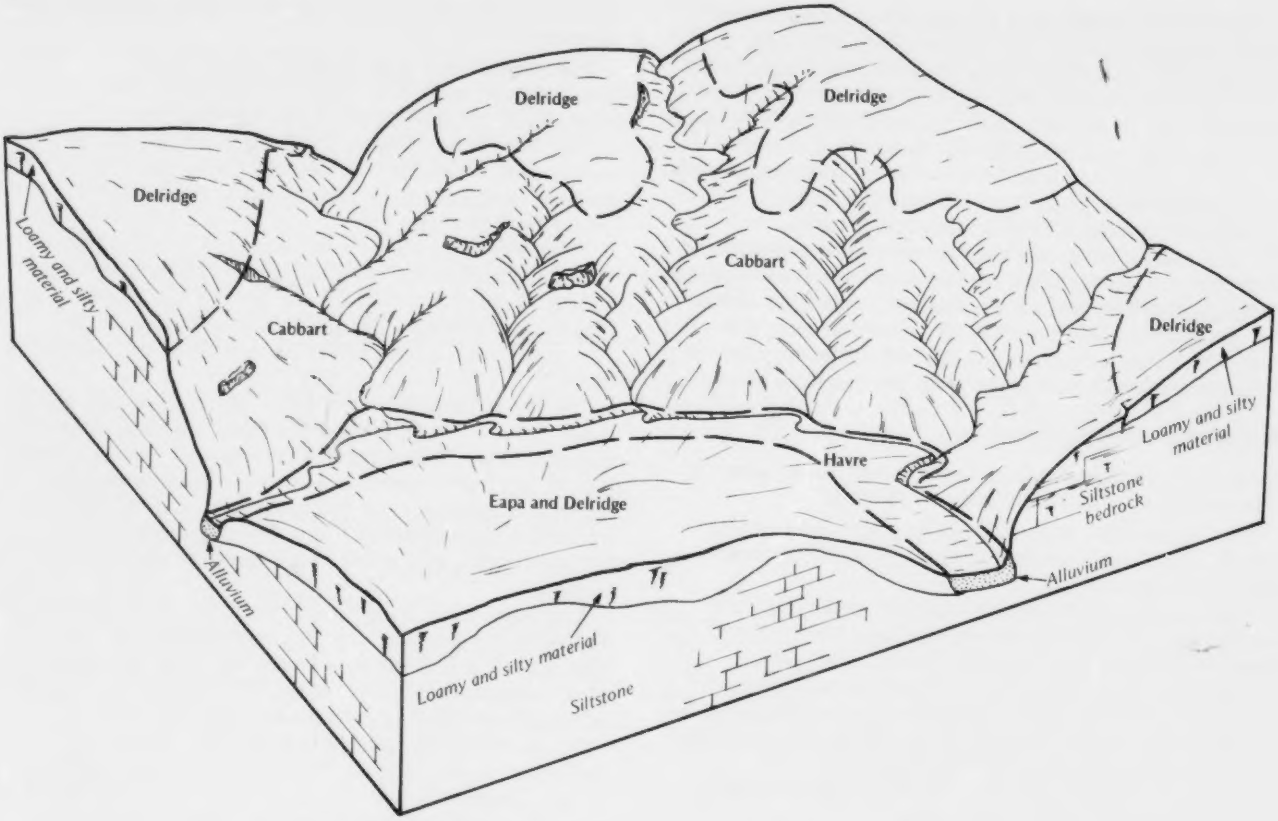

Figure 4.—Pattern of soils and parent material in the Cabbart-Delridge association.

Minor in this association are Bullock, Cabbart, Delridge, Eapa, Marmarth, Parchin, and Tanna soils. The sodium affected Bullock and Parchin soils are throughout the association. The shallow Cabbart and moderately deep Delridge soils generally are on the high parts of the landscape. The moderately deep Marmarth and Tanna soils and the deep Eapa soils are on the less sloping parts of the landscape.

About 80 percent of this association is range. Controlling erosion is the main concern of management. The association is suited to range and rangeland wildlife habitat. The Assinniboine and Twilight soils are suited to cultivated crops and to tame pasture and hay. Alfalfa and small grain are the main crops.

7. Cabbart-Delridge Association

Shallow and moderately deep, well drained, gently sloping to steep, loamy soils on uplands

This association is on uplands characterized by smooth, sloping areas and deeply dissected, steeper areas. In most areas the drainage pattern is well defined.

This association makes up about 8 percent of the survey area. It is about 50 percent Cabbart soils, 30 percent Delridge soils, and 20 percent minor soils (fig. 4).

The shallow Cabbart soils are on the steeper side slopes. Slopes range from 9 to 40 percent. Typically, the surface layer is light brownish gray, calcareous loam. The underlying material is light gray, calcareous loam. Pale yellow, soft siltstone is at a depth of about 15 inches.

The moderately deep Delridge soils are on the higher parts of the landscape. In this association slopes range from 2 to 15 percent. Typically, the surface layer is grayish brown, calcareous loam. The next layer also is grayish brown, calcareous loam. The underlying material is light brownish gray, calcareous silt loam and loam. Light gray, soft siltstone is at a depth of about 24 inches.

Minor in this association are Blackhall, Eapa, Havre, Savo, and Tanna soils. The shallow Blackhall soils contain more sand throughout than the major soils. They are in positions on the landscape similar to those of the Cabbart soils. The deep Eapa and Savo soils are on high terraces. The deep, stratified Havre soils are on flood plains. The moderately deep, silty Tanna soils are slightly lower on the landscape than the Delridge soils.

About 80 percent of this association is range. Controlling erosion is the main concern of management. Improving fertility also is a management concern in areas of the Delridge soils. The association is suited to range and rangeland wildlife habitat. The Delridge soils are suited to cultivated crops, but the high content of lime is a limitation. Alfalfa and small grain are the main crops.

8. Eapa-Delridge Association

Deep and moderately deep, well drained, nearly level to moderately sloping, loamy soils on uplands

This association is on uplands characterized by low ridges and shallow swales. In most areas the drainage pattern is well defined.

This association makes up about 11 percent of the survey area. It is about 48 percent Eapa soils, 17 percent Delridge soils, and 35 percent minor soils.

The deep Eapa soils are in smooth areas. Slopes range from 0 to 9 percent. Typically, the surface layer is grayish brown loam. The subsoil is grayish brown, brown, and light brownish gray clay loam and loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous loam.

The moderately deep Delridge soils are on the ridges. In this association slopes range from 2 to 9 percent. Typically, the surface layer is grayish brown, calcareous loam. The underlying material is light brownish gray, calcareous silt loam and loam. Light gray, soft siltstone is at a depth of about 24 inches.

Minor in this association are Cabbart, Grail, Havre, Savo, and Tanna soils. The shallow Cabbart soils are on the ridges and along deep drainageways. The deep Grail soils are dark to a depth of more than 16 inches. They are in the swales. The deep, stratified Havre soils are on flood plains. The deep, silty Savo soils are in positions on the landscape similar to those of the Eapa soils. The moderately deep, silty Tanna soils are in positions on the landscape similar to those of the Delridge soils.

About 55 percent of this association is cropland. Alfalfa and small grain are the main crops. Controlling erosion is the main concern of management. Improving fertility also is a management concern in areas of the Delridge soils. The association is suited to cultivated crops and to tame pasture and hay, range, and both openland and rangeland wildlife habitat.

9. Eapa-Tanna-Savo Association

Deep and moderately deep, well drained, nearly level to moderately sloping, loamy and silty soils on uplands and terraces

This association is on uplands and terraces characterized by gentle rises and shallow swales. In most areas the drainage pattern is well defined.

This association makes up about 5 percent of the survey area. It is about 32 percent Eapa soils, 32 percent Tanna soils, 21 percent Savo soils, and 15 percent minor soils.

The deep Eapa soils have a slope of 0 to 9 percent. Typically, the surface layer is grayish brown loam. The subsoil is grayish brown, brown, and light brownish gray clay loam and loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous loam.

The moderately deep Tanna soils have a slope of 0 to 9 percent. Typically, the surface layer is grayish brown silty clay loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is light brownish gray silty clay loam. Light brownish gray, soft shale is at a depth of about 32 inches.

The deep Savo soils have a slope of 2 to 9 percent. Typically, the surface layer is grayish brown silt loam. The subsoil is grayish brown silty clay and light brownish gray, calcareous silty clay loam. The underlying material is light brownish gray, calcareous silty clay loam.

Minor in this association are Cabbart, Delridge, Gerdrum, and Grail soils. The shallow Cabbart soils are on the steeper parts of the landscape. The moderately deep, loamy Delridge soils are on ridges. The sodium affected Gerdrum soils are in nearly level areas. The Grail soils are dark to a depth of more than 16 inches. They are in swales.

About 60 percent of this association is cropland. Alfalfa and small grain are the main crops. Conserving moisture and controlling erosion are the main concerns in managing the major soils for crops. The association is suited to cultivated crops and to tame pasture and hay, range, and both openland and rangeland wildlife habitat.

Nearly Level to Moderately Sloping, Loamy and Silty, Sodium Affected Soils on Uplands and Terraces

These soils dominantly are nearly level and gently sloping but are moderately sloping in places. They make up about 24 percent of the survey area. About 95 percent of the acreage is range. Controlling erosion is the main management concern.

10. Gerdrum-Absher-Loburn Association

Deep, well drained, nearly level and gently sloping, sodium affected, loamy and silty soils on uplands and terraces

This association is on uplands and terraces characterized by gentle rises and smooth areas with small depressions. Slopes mainly are nearly level and gently sloping but are steeper along drainageways. In most areas the drainage pattern is well defined, but it is poorly defined in some nearly level areas.

This association makes up about 5 percent of the survey area. It is about 40 percent Gerdrum soils, 25 percent Absher soils, 20 percent Loburn soils, and 15 percent minor soils.

The loamy Gerdrum soils generally are in smooth areas. Slopes range from 0 to 4 percent. Typically, the surface layer is light brownish gray loam. The subsoil is grayish brown and light brownish gray clay loam and clay. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous clay loam.

The silty Absher soils generally are in small pits and depressions. Slopes range from 2 to 6 percent. Typically, the surface layer is light brownish gray silt loam. The subsoil is grayish brown and light brownish gray silty clay. In the lower part it is calcareous and has visible salts and gypsum crystals. The underlying material is light brownish gray, calcareous silty clay loam. It has visible salts and gypsum crystals throughout.

The loamy Loburn soils generally are on the more convex parts of the landscape. Slopes range from 0 to 3 percent. Typically, the surface layer is grayish brown loam. The subsurface layer is light brownish gray loam. The subsoil is brown and light brownish gray clay, silty clay loam, and clay loam. It has visible salts and gypsum crystals in the lower part. The underlying material is light brownish gray sandy clay loam. It has visible salts and gypsum crystals throughout.

Minor in this association are the Abor, Lawther, Savo, and Tanna soils, which do not have a sodium affected subsoil. Abor, Savo, and Tanna soils generally are higher

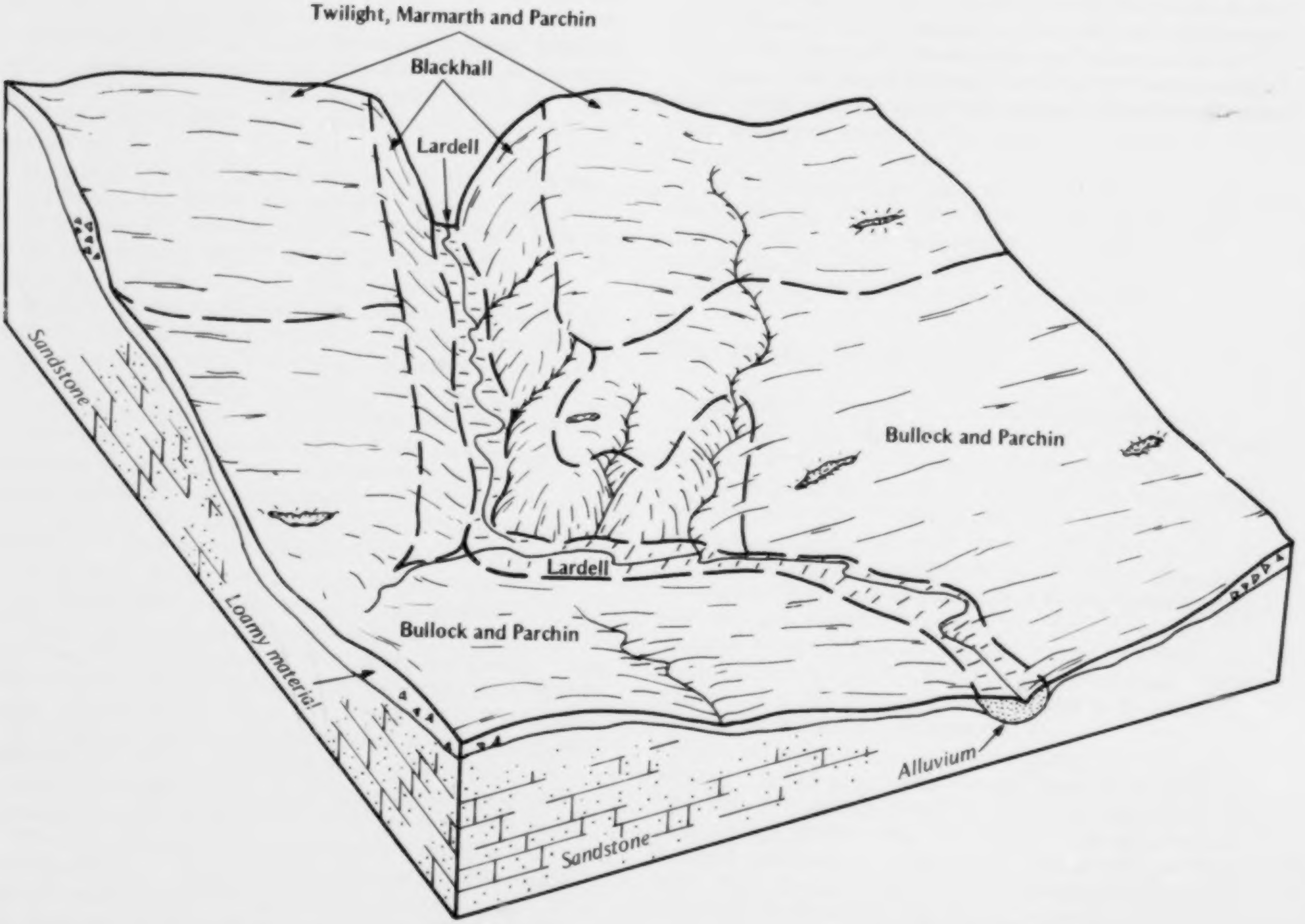

Figure 5.—Pattern of soils and parent material in the Bullock-Parchin association.

on the landscape than the major soils, and Lawther soils generally are lower.

Nearly all of this association supports native grasses and is used for range. Conserving moisture and improving tilth are the main management concerns in cultivated areas. The association is suited to range and rangeland wildlife habitat. The Gerdrum and Loburn soils are suited to cultivated crops, but the sodium affected subsoil is a limitation. Alfalfa and small grain are the main crops.

11. Bullock-Parchin Association

Moderately deep, well drained, nearly level to moderately sloping, sodium affected, loamy soils on uplands

This association is on uplands characterized by smooth areas, gentle rises, and ridges. The drainage pattern is well defined in most areas.

This association makes up about 19 percent of the survey area. It is about 29 percent Bullock soils, 27 percent Parchin soils, and 44 percent minor soils (fig. 5).

The Bullock soils have a slope of 0 to 9 percent. Typically, the surface layer is grayish brown fine sandy loam. The subsoil is brown and grayish brown sandy clay loam and sandy loam. The underlying material is light brownish gray sandy loam. Light gray, soft sandstone is at a depth of about 22 inches.

The Parchin soils have a slope of 0 to 6 percent. Typically, the surface layer is brown fine sandy loam. The subsurface layer is pale brown fine sandy loam. The subsoil is brown sandy clay loam. Light brownish gray, soft sandstone is at a depth of about 32 inches.

Minor in this association are Assinniboine, Blackhall, Lardell, Marmarth, and Twilight soils, which do not have a sodium affected subsoil. Assinniboine, Blackhall, Marmarth, and Twilight soils typically are higher on the landscape than the major soils. The somewhat poorly drained Lardell soils are on flood plains. Also of minor extent are Slickspots, which are in small areas throughout the association, in positions on the landscape similar to those of the Bullock soils.

Nearly all of this association supports native grasses and is used for range. Controlling erosion is the main concern of management. The association is suited to range and to rangeland wildlife habitat. It generally is unsuited to cultivated crops and to tame pasture and hay because of the sodium affected subsoil in the major soils.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Eapa loam, 0 to 2 percent slopes, is one of several phases in the Eapa series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Eapa-Grail complex, 2 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The names of some map units identified on the detailed soil maps do not fully agree with those identified on the maps in the published surveys of Butte and Perkins Counties and Meade County, Southern Part, which are adjacent to this survey area. Differences are the result of variations in the design and composition of map units or changes and refinements in series concepts.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AbB—Abor silty clay, 2 to 6 percent slopes. This moderately deep, well drained, calcareous, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 150 acres in size.

Typically, the surface layer is grayish brown silty clay about 5 inches thick. The subsoil is light brownish gray, firm silty clay about 17 inches thick. The underlying material is light brownish gray silty clay. The soil is calcareous throughout. Light yellowish brown shale is at a depth of about 27 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Absher, Tanna, and Yawdim soils. These soils make up less than 15 percent of any one mapped area. Absher soils have a sodium affected subsoil. They are in small pits and depressions. Tanna soils have a dark surface layer. They are in positions on the landscape similar to those of the Abor soil. Yawdim soils are 10 to 20 inches deep to bedrock. They are on the higher, more convex parts of the landscape.

Fertility and the content of organic matter are low in the Abor soil. Tilth is poor. Available water capacity is low. Permeability is slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricting grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but the high content of lime in the surface layer and subsoil adversely affects the availability of plant nutrients. Examples of suitable pasture plants are alfalfa and intermediate wheatgrass. Alfalfa, oats, and winter wheat are the main crops. Conserving moisture, controlling erosion, and improving tilth are the main management needs in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to conserve moisture and control erosion. Contour farming and grassed waterways also help to control erosion. Subsoiling or chiseling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings; however, it takes in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth and survival are unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

AbC—Abor silty clay, 6 to 9 percent slopes. This moderately deep, well drained, calcareous, moderately sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 10 to 100 acres in size.

Typically, the surface layer is grayish brown silty clay about 5 inches thick. The subsoil is light brownish gray, firm silty clay about 17 inches thick. The underlying material is light brownish gray silty clay. The soil is calcareous throughout. Light yellowish brown shale is at a depth of about 27 inches. In some areas the depth to bedrock is more than 40 inches.

Included with this soil in mapping are small areas of Delridge, Tanna, and Yawdim soils. These soils make up less than 15 percent of any one mapped area. Delridge soils contain less clay throughout than the Abor soil. Also, they are higher on the landscape. Tanna soils have a dark surface layer. They are in positions on the landscape similar to those of the Abor soil. Yawdim soils are 10 to 20 inches deep to bedrock. They are on ridges.

Fertility and the content of organic matter are low in the Abor soil. Tilth is poor. Available water capacity is low. Permeability is slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricting grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to cultivated crops and to tame pasture and hay, but the high content of lime in the surface layer and subsoil adversely affects the availability of plant nutrients. Examples of suitable pasture plants are alfalfa and intermediate wheatgrass. Alfalfa, oats, and winter wheat are the main crops. Conserving moisture, controlling erosion, and improving tilth are the main management needs in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to conserve moisture and control erosion. Contour farming, grassed waterways, and terraces also help to control erosion. Subsoiling or chiseling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings; however, it takes in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth and survival are unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-14, Clayey range site; windbreak suitability group 4C.

AlB—Absher-Slickspots complex, 2 to 6 percent slopes. This map unit occurs as areas of a deep, well drained, gently sloping Absher soil closely intermingled with Slickspots. It is on terraces and uplands. The Absher soil is on the high parts of the landscape. The Slickspots are in slight depressions. Areas are irregular in shape and 10 to more than 100 acres in size. They are 65 to 75 percent Absher soil and 20 to 30 percent Slickspots. The Absher soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Absher soil is light brownish gray silt loam about 2 inches thick. The subsoil is grayish brown and light brownish gray, firm silty clay about 17 inches thick. In the lower part it is calcareous and has salts and gypsum. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay loam. It has salts and gypsum throughout.

The Slickspots occur as slightly depressed, barren areas that have a puddled or slick surface. Visible accumulations of salts are at or near the surface. The soil material to a depth of 60 inches is massive silty clay loam.

Included with the Absher soil and the Slickspots in mapping are small areas of Lawther and Loburn soils. These included soils make up less than 15 percent of any one mapped area. Lawther soils do not have a sodium affected subsoil. They are on the higher, convex parts of the landscape. Loburn soils have a surface layer that is thicker than that of the Absher soil. They are on slight rises.

Fertility and the content of organic matter are low in the Absher soil. Tilth is poor. This soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is moderate or high. Permeability is very slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. The Slickspots generally support little or no vegetation, but they do support a sparse stand of weeds and pricklypear during wet periods.

This map unit generally is unsuited to cultivated crops, windbreaks and environmental plantings, and tame pasture and hay. The sodium affected subsoil of the Absher soil and the salts in the Slickspots are limitations.

The Absher soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or a windbreak suitability group.

AsB—Assinniboine fine sandy loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to 300 acres in size.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil is about 19 inches thick. The upper part is brown, friable sandy clay loam. The lower part is pale brown, friable fine sandy loam. It is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is pale brown, calcareous fine sandy loam. In some areas the soil does not have free carbonates. In other areas soft bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of Delridge and Grail soils. These soils make up less than 15 percent of any one mapped area. Delridge soils are 20 to 40 inches deep over soft bedrock and have less sand throughout than the Assinniboine soil. They are on the high parts of the landscape. Grail soils contain more clay throughout than the Assinniboine soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium and the content of organic matter moderate in the Assinniboine soil. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, wind erosion is a hazard if the range is overgrazed.

This soil is suited to cultivated crops and to tame pasture and hay (fig. 6). Examples of suitable pasture plants are alfalfa, crested wheatgrass, and intermediate wheatgrass. Alfalfa, oats, winter wheat, and grain sorghum are the main crops. Controlling wind erosion and conserving moisture are the main management concerns in cultivated areas. Leaving crop residue on the surface, stripcropping, and minimizing tillage help to control wind erosion and conserve moisture. Establishing field windbreaks also helps to control wind erosion.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IVe-6; Sandy range site; windbreak suitability group 5.

AsC—Assinniboine fine sandy loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 20 to 200 acres in size. Slopes are short and convex.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil is about 19 inches thick. The upper part is brown, friable sandy clay loam. The lower part is pale brown, friable fine sandy loam. It is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is pale brown, calcareous fine sandy loam. In some areas the soil does not have free carbonates. In places soft bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of Blackhall, Delridge, and Grail soils. These soils make up less than 15 percent of any one mapped area. Blackhall and Delridge soils are on the high parts of the landscape. Blackhall soils are 10 to 20 inches deep over soft bedrock. Delridge soils are 20 to 40 inches deep over soft bedrock and have less sand throughout than the Assinniboine soil. Grail soils contain more clay throughout than the Assinniboine soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium and the content of organic matter moderate in the Assinniboine soil. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, wind erosion is a hazard if the range is overgrazed.

This soil is suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa and intermediate wheatgrass. Alfalfa, oats, winter wheat, and grain sorghum are the main crops. Controlling erosion and conserving moisture are the main management concerns in cultivated areas. Leaving crop residue on the surface, stripcropping, and minimizing tillage help to control wind erosion and conserve

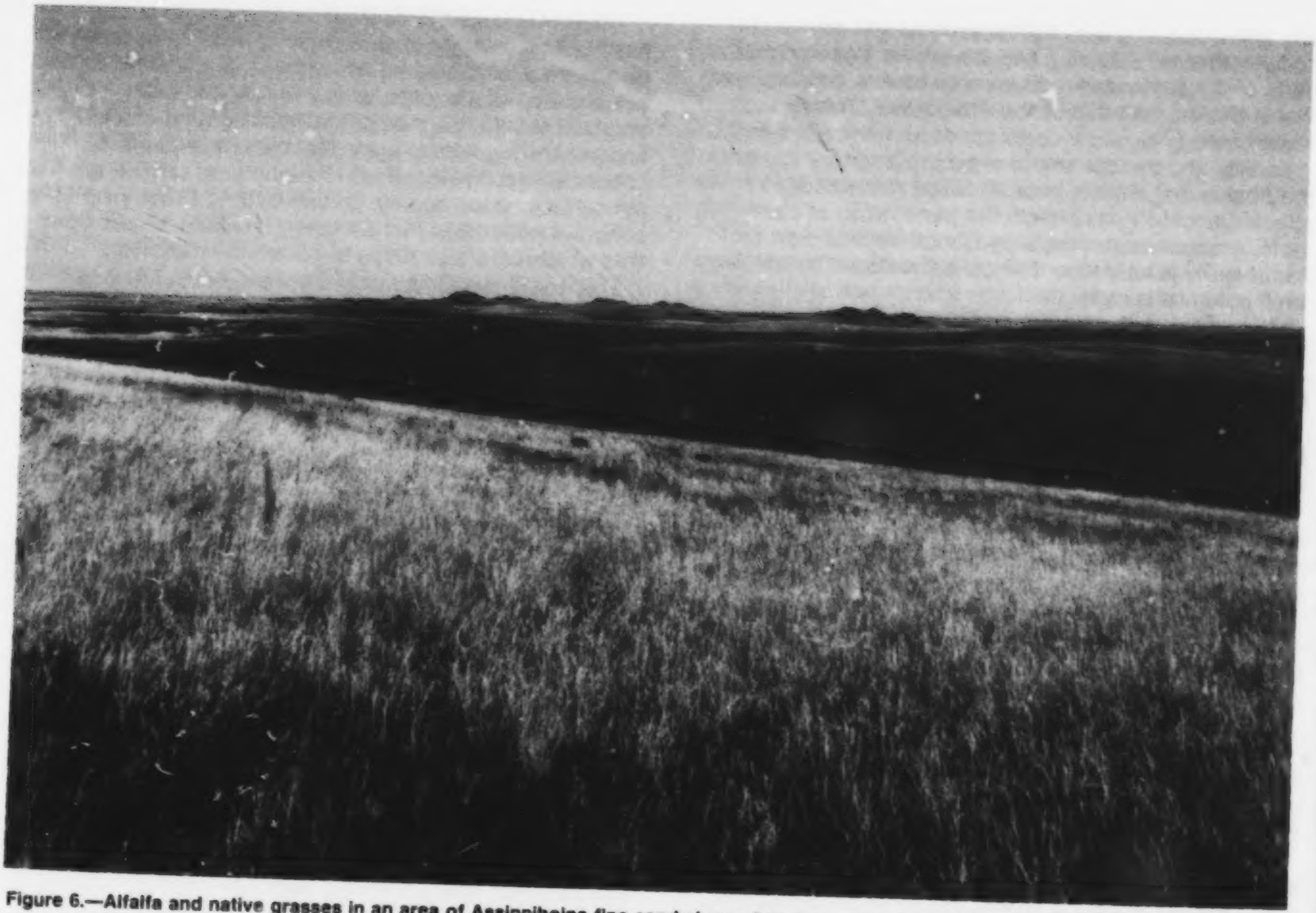

Figure 6.—Alfalfa and native grasses in an area of Assinniboine fine sandy loam, 2 to 6 percent slopes. The alfalfa is in the background.

moisture. Contour farming, grassed waterways, and terraces help to control water erosion.

This soil is suited to the windbreaks and environmental plantings that do not require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IVe-7; Sandy range site; windbreak suitability group 5.

AtC—Assinniboine-Twilight fine sandy loams, 6 to 9 percent slopes. These well drained, moderately sloping soils are on uplands. The deep Assinniboine soil is on the smooth parts of the landscape. The moderately deep Twilight soil is on the more sloping parts. Areas are irregular in shape and 10 to 250 acres in size. They are 50 to 60 percent Assinniboine soil and 30 to 35 percent Twilight soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Assinniboine soil is brown fine sandy loam about 7 inches thick. The subsoil is about 19 inches thick. The upper part is brown, friable sandy clay loam. The lower part is pale brown, friable fine sandy loam. It is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is pale brown, calcareous fine sandy loam. In some areas the soil does not have free carbonates.

Typically, the surface layer of the Twilight soil is dark grayish brown fine sandy loam about 3 inches thick. The subsoil is brown, very friable fine sandy loam about 15 inches thick. It is calcareous in the lower part. The underlying material is light gray, calcareous fine sandy loam. Light gray, soft sandstone is at a depth of about 36 inches. In places the soil does not have free carbonates.

Included with these soils in mapping are small areas of Blackhall and Grail soils. These included soils make up less than 15 percent of any one mapped area. Blackhall soils are 10 to 20 inches deep over soft bedrock. They are on the high parts of the landscape. Grail soils contain more clay throughout than the Assinniboine soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium in the Assinniboine soil and low in the Twilight soil. The content of organic matter is moderate in the Assinniboine soil and low in the Twilight soil. Available water capacity is moderate or high in the Assinniboine soil and low in the Twilight soil. Tilth is good in both soils. Permeability is moderate in the Assinniboine soil and moderately rapid in the Twilight soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, wind erosion is a hazard if the range is overgrazed.

These soils are suited to cultivated crops and to tame pasture and hay. Examples of suitable pasture plants are alfalfa and intermediate wheatgrass. Alfalfa, oats, winter wheat, and grain sorghum are the main crops. Measures that control erosion and conserve moisture are the main management needs. Leaving crop residue on the surface, stripcropping, and minimizing tillage help to control wind erosion. Contour farming and grassed waterways help to control water erosion.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well on the Assinniboine soil, except for those that require an abundant supply of moisture. Optimum growth should not be expected on the Twilight soil because it is droughty.

The capability unit is IVe-7; Sandy range site. The Assinniboine soil is in windbreak suitability group 5; the Twilight soil is in windbreak suitability group 6R.

Ba—Bankard loamy fine sand. This deep, somewhat excessively drained, calcareous, nearly level soil is on flood plains. It is occasionally flooded. Areas are irregular in shape and 20 to 100 acres in size.

Typically, the surface layer is grayish brown loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches is stratified, light brownish gray fine sand and fine sandy loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of the loamy Glenberg and silty Lohmiller soils. These soils make up less than 10 percent of any one mapped area. They contain more silt and clay throughout than the Bankard soil. Also, they are farther from the river.

Fertility and the content of organic matter are low in the Bankard soil. Tilth is poor. Available water capacity is low. Permeability is rapid. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Wind erosion is a hazard. Sand blowouts can form in overgrazed areas. Maintaining an adequate plant cover helps to control wind erosion. Range seeding may be needed on some sites.

This soil generally is unsuited to cultivated crops and to tame pasture and hay. Erosion is a severe hazard, and the low fertility and low available water capacity are limitations.

This soil is suited to environmental plantings, but only evergreen trees and shrubs can be successfully established. Planting the trees and shrubs directly in sod helps to control wind erosion.

The capability unit is VIe-8; Sands range site; windbreak suitability group 7.

Bb—Bankard gravelly loamy sand. This deep, somewhat excessively drained, calcareous, nearly level soil is on flood plains. It is frequently flooded. Areas are long and narrow and range from 10 to 80 acres in size.

Typically, the surface layer is light brownish gray, calcareous gravelly loamy sand about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous gravelly fine sand.

Included with this soil in mapping are small areas of the loamy Glenberg soils. These soils make up less than 10 percent of any one mapped area. They contain more silt and less sand throughout than the Bankard soil. Also, they are farther from the river.

Fertility and the content of organic matter are low in the Bankard soil. Tilth is poor. Available water capacity is low. Permeability is very rapid. Runoff is slow.

All of the acreage supports native grasses and is used for grazing. Productivity is low because in some areas this soil is scoured and in others sand has been deposited by floodwater. Some areas support a sparse stand of deciduous trees and shrubs.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because it is frequently flooded.

The capability unit is VIw-3; Sands range site; windbreak suitability group 10.

BlE—Blackhall-Rock outcrop complex, 15 to 40 percent slopes. This map unit occurs as areas of a moderately steep and steep, shallow, well drained Blackhall soil intermingled with areas where sandstone crops out. It is on uplands. The Blackhall soil generally is on side slopes. The Rock outcrop is on the upper, convex slopes. Areas are irregular in shape and 20 to 400 acres in size. They are 60 to 70 percent Blackhall soil and 20 to 30 percent Rock outcrop. The Blackhall soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Blackhall soil is grayish brown fine sandy loam about 5 inches thick. The underlying material is olive fine sandy loam. Pale olive, soft sandstone is at a depth of about 11 inches. The soil is calcareous throughout. In places the content of clay is higher.

The Rock outcrop is weakly cemented to strongly cemented sandstone.

Included with the Blackhall soil and Rock outcrop in mapping are small areas of the moderately deep Twilight soils on low side slopes. These included soils make up less than 15 percent of any one mapped area.

Fertility and the content of organic matter are low in the Blackhall soil. Available water capacity is very low. Permeability is moderately rapid. Runoff is rapid.

All of the acreage supports native grasses and is used for grazing. Water erosion and wind erosion are hazards unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This map unit is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Blackhall soil is in capability unit VIIe-3, Shallow range site, and windbreak suitability group 10; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site or a windbreak suitability group.

BmE—Blackhall-Twilight fine sandy loams, 9 to 40 percent slopes. These well drained, strongly sloping to steep soils are on uplands. The shallow Blackhall soil generally is on convex ridgetops. The moderately deep Twilight soil generally is on the less sloping side slopes. Areas are irregular in shape and 20 to 600 acres in size. They are 45 to 55 percent Blackhall soil and 35 to 45 percent Twilight soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Blackhall soil is grayish brown fine sandy loam about 5 inches thick. The underlying material is olive fine sandy loam. Pale olive, soft sandstone is at a depth of about 11 inches. The soil is calcareous throughout.

Typically, the surface layer of the Twilight soil is dark grayish brown fine sandy loam about 3 inches thick. The subsoil is brown, very friable fine sandy loam about 15 inches thick. It is calcareous in the lower part. The underlying material is light gray, calcareous fine sandy loam. Light gray, soft sandstone is at a depth of about 36 inches. In places the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Grail soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The deep Grail soils contain more clay throughout than the Blackhall and Twilight soils. They are in swales. The Rock outcrop is soft sandstone, siltstone, or clayey shale. It is on the steeper parts of the landscape.

Fertility and the content of organic matter are low in the Blackhall and Twilight soils. Available water capacity is very low in the Blackhall soil and low in the Twilight soil. Permeability is moderately rapid in both soils. Runoff is medium or rapid.

Most of the acreage supports native grasses and is used for grazing. Water erosion and wind erosion are hazards unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope of both soils and the depth to bedrock in the Blackhall soil. The less sloping areas of the Twilight soil, however, can be seeded to tame pasture plants or used for environmental plantings.

The Blackhall soil is in capability unit VIIe-3, Shallow range site; the Twilight soil is in capability unit VIe-7, Sandy range site. Both soils are in windbreak suitability group 10.

BoE—Bullock-Lardell-Blackhall complex, 2 to 40 percent slopes. These gently sloping to steep soils are on uplands and narrow flood plains. The moderately deep, well drained Bullock soil is on the less sloping parts of the uplands. The deep, somewhat poorly drained Lardell soil is on the flood plains. The shallow, well drained Blackhall soil is on ridges. Areas are 50 to 500 acres in size. They are 30 to 40 percent Bullock soil, 30 to 40 percent Lardell soil, and 15 to 25 percent Blackhall soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Bullock soil is grayish brown fine sandy loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is brown, friable sandy clay loam. The lower part is grayish brown, friable, calcareous sandy loam. It has visible crystals of gypsum and other salts. The underlying material is light brownish gray, calcareous sandy loam that has visible crystals of gypsum and other salts. Light gray, soft sandstone interbedded with thin layers of siltstone is at a depth of about 22 inches. In places the subsoil contains more clay. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Lardell soil is light gray fine sandy loam about 1 inch thick. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, stratified sandy clay loam, sandy loam, and clay loam. The soil is calcareous and has many crystals of salt throughout.

Typically, the surface layer of the Blackhall soil is grayish brown fine sandy loam about 5 inches thick. The underlying material is olive, fine sandy loam. Pale olive, soft sandstone is at a depth of about 11 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Marmarth and Twilight soils, Rock outcrop, and Slickspots. These inclusions make up less than 20 percent of any one mapped area. The Marmarth and Twilight soils are on the less sloping parts of the landscape. They are 20 to 40 inches deep over soft bedrock. Rock outcrop is on ridges. It is soft sandstone, siltstone, or clayey shale. Slickspots are in small pits and depressions. They have a dispersed surface and have a high content of salts throughout.

Fertility and the content of organic matter are low in the Bullock, Lardell, and Blackhall soils. The Bullock soil has a sodium affected subsoil that restricts root penetration. The Lardell soil has a high concentration of salts throughout that adversely affects the growth of most plants. Available water capacity is low in the Bullock and Lardell soils and very low in the Blackhall soil. Permeability is slow or very slow in the Bullock soil, slow in the Lardell soil, and moderately rapid in the Blackhall soil. The Lardell soil has a seasonal high water table at a depth of 1.5 to 3.0 feet. Runoff is slow on the Bullock and Lardell soils and rapid on the Blackhall soil. The shrink-swell potential is moderate in the Bullock and Lardell soils. It is low in the Blackhall soil.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem in areas of the Bullock soil. The Lardell soil has an excess of salts and supports salt tolerant grasses. The moderately steep and steep Blackhall soil is subject to wind erosion and water erosion unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. A claypan subsoil in the Bullock soil, the high concentration of salts, and the slope are limitations.

The Bullock soil is in capability unit VIs-3, Thin Claypan range site; the Lardell soil is in capability unit VIw-3, Saline Lowland range site; the Blackhall soil is in capability unit VIIe-3, Shallow range site. All three soils are in windbreak suitability group 10.

BpB—Bullock-Parchin fine sandy loams, 0 to 4 percent slopes. These moderately deep, well drained, nearly level and gently sloping soils are on uplands. The Bullock soil is in small pits and depressions. The Parchin soil is on slight rises. Areas are irregular in shape and 20 to more than 600 acres in size. They are 45 to 55 percent Bullock soil and 30 to 35 percent Parchin soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Bullock soil is grayish brown fine sandy loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is brown, friable sandy clay loam. The lower part is grayish brown, friable, calcareous sandy loam. It has visible crystals of gypsum and other salts. The underlying material is light brownish gray, calcareous sandy loam that has visible crystals of gypsum and other salts. Light gray, soft sandstone interbedded with thin layers of siltstone is at a depth of about 22 inches. In places the subsoil contains more clay. In some areas the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Parchin soil is brown fine sandy loam about 6 inches thick. The subsurface layer is pale brown fine sandy loam about 6 inches thick. The subsoil is brown, friable sandy clay loam about 20 inches thick. In the lower part it is calcareous and has visible crystals of gypsum and other salts. Light brownish gray, calcareous, soft sandstone is at a depth of about 32 inches. In places the depth to sandstone is more than 40 inches. In some areas the subsoil contains more clay.

Included with these soils in mapping are small areas of Marmarth and Twilight soils and Slickspots. These inclusions make up less than 20 percent of any one mapped area. Marmarth and Twilight soils are on the high parts of the landscape. They do not have a sodium affected subsoil. Slickspots have a dispersed surface and have a high content of salts throughout. They are in small pits and depressions.

Fertility and the content of organic matter are low in the Bullock and Parchin soils. Tilth is poor in the Bullock soil and fair in the Parchin soil. Both soils have a sodium affected subsoil that restricts root penetration. Available water capacity is low. Permeability is slow or very slow. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing (fig. 7). Compaction is a problem on the Bullock soil. Wind erosion is a hazard in overgrazed areas of the Parchin soil. Range seeding may be needed on some sites.

This map unit generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Although the Parchin soil is suited to these uses, the use of this map unit is determined by the suitability of the Bullock soil. The sodium affected subsoil in both soils is the main limitation. Environmental plantings can be established in areas of the Parchin soil, but optimum growth and survival are unlikely.

The capability unit is VIs-3. The Bullock soil is in Thin Claypan range site, windbreak suitability group 10; the Parchin soil is in Claypan range site, windbreak suitability group 9.

BsB—Bullock-Slickspots complex, 0 to 4 percent slopes. This map unit occurs as areas of a moderately deep, well drained, nearly level and gently sloping Bullock soil intermingled with Slickspots. It is on uplands. The Bullock soil is on the high parts of the landscape. The Slickspots are in slight depressions. Areas are

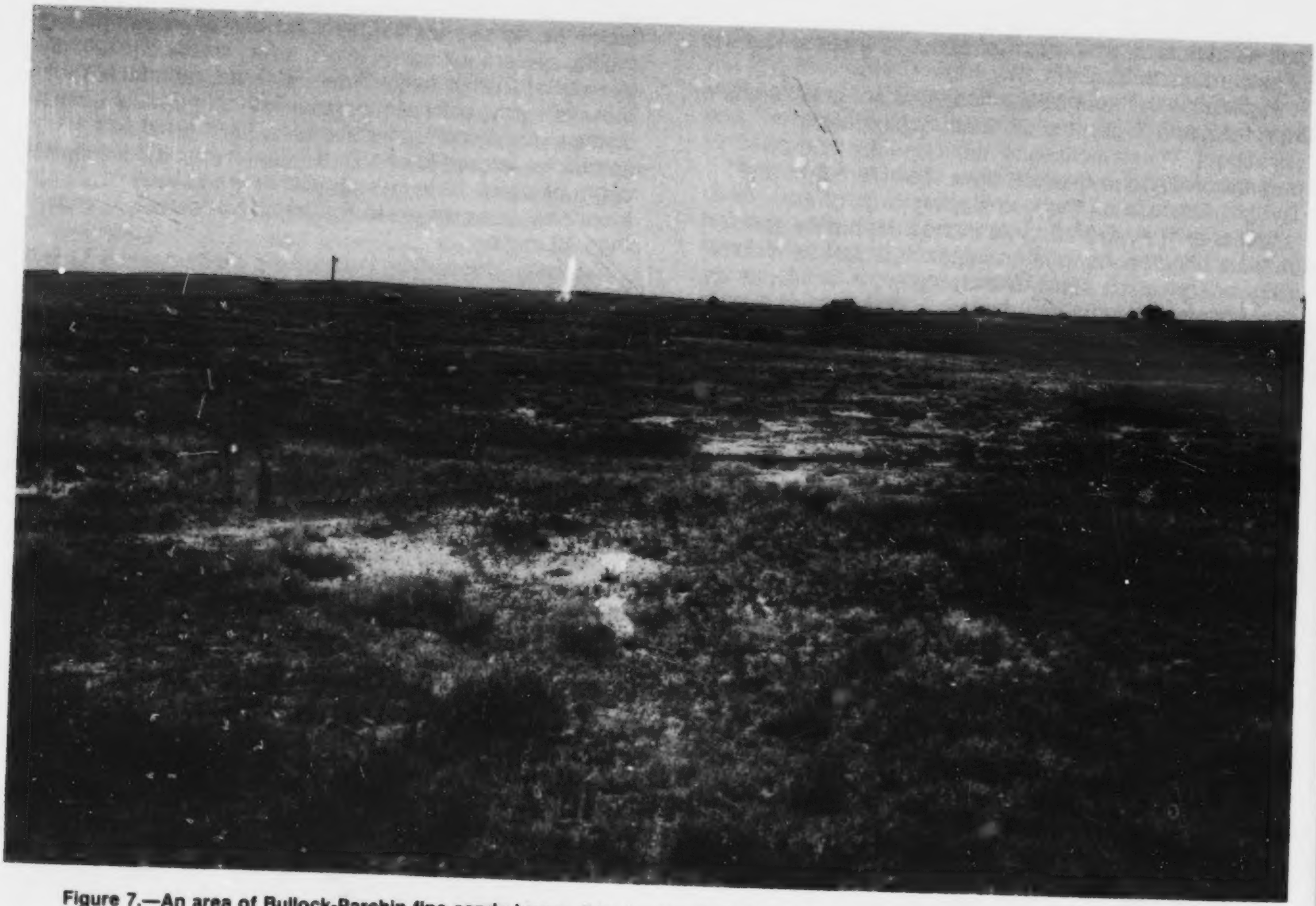

Figure 7.—An area of Bullock-Parchin fine sandy loams, 0 to 4 percent slopes, used for range. The white areas are Slickspots.

irregular in shape and 15 to more than 500 acres in size. They are 55 to 65 percent Bullock soil and 25 to 30 percent Slickspots. The Bullock soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Bullock soil is grayish brown fine sandy loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is brown, friable sandy clay loam. The lower part is grayish brown, friable, calcareous sandy loam. The underlying material is light brownish gray, calcareous sandy loam that has visible crystals of gypsum and other salts. Light gray, soft sandstone interbedded with thin layers of siltstone is at a depth of about 22 inches. In places the subsoil contains more clay. In some areas the depth to bedrock is more than 40 inches.

The Slickspots occur as slightly depressed, barren areas that have a puddled or slick surface. Visible accumulations of salts are at or near the surface. The soil material to a depth of about 25 inches is massive clay loam.

Included with the Bullock soil and the Slickspots in mapping are small areas of Delridge, Eapa, Marmarth, Parchin, and Twilight soils. These included soils make up less than 15 percent of any one mapped area. Delridge, Eapa, Marmarth, and Twilight soils are higher on the landscape than the Bullock soil. They do not have a sodium affected subsoil. Parchin soils have a surface soil that is thicker than that of the Bullock soil. They are on slight rises.

Fertility and the content of organic matter are low in the Bullock soil. Tilth is poor. This soil has a sodium affected subsoil that restricts the penetration of roots. Available water capacity is low. Permeability is very slow or slow. Runoff is slow or medium. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This map unit generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The sodium affected subsoil of the Bullock soil and the salts in the Slickspots are limitations.

The Bullock soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or a windbreak suitability group.

CaD—Cabbart loam, 9 to 40 percent slopes. This shallow, well drained, strongly sloping to steep soil is on uplands. Areas are irregular in shape and 10 to more than 1,000 acres in size.

Typically, the surface layer is light brownish gray loam about 3 inches thick. The underlying material is light gray loam. Pale yellow, soft siltstone is at a depth of about 15 inches. The soil is calcareous throughout. In places the content of sand is higher.

Included with this soil in mapping are small areas of the moderately deep Delridge soils on side slopes. These soils make up less than 15 percent of any one mapped area.

Fertility and the content of organic matter are low in the Cabbart soil. Available water capacity is very low. Permeability is moderate. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This soil generally is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIe-2; Shallow range site; windbreak suitability group 10.

CvB—Cabbart Variant loam, 2 to 6 percent slopes. This shallow, well drained, gently sloping soil is on Fox Ridge, in the northeastern part of the county. It occurs as a mesa several hundred feet above the surrounding landscape. Areas are long and narrow and are 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 2 inches thick. The subsoil is dark grayish brown, friable silt loam. White, fractured limestone is at a depth of about 12 inches.

Included with this soil in mapping are small areas of Eapa soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The deep Eapa soils are in swales and nearly level areas. The Rock outcrop is hard limestone. It is in rimrock areas.

Fertility and the content of organic matter are moderate in the Cabbart Variant soil. Available water capacity is very low. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate.

All of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, obtaining a uniform distribution of grazing is difficult because water supplies are some distance away from this mesa.

This soil generally is too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIs-1; Shallow range site; windbreak suitability group 10.

DeC—Delridge-Cabbart loams, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands (fig. 8). The moderately deep Delridge soil is on the less sloping parts of the landscape. The shallow Cabbart soil is on the steeper, convex slopes above the Delridge soil. Areas are irregular in shape and 20 to 400 acres in size. They are 55 to 65 percent Delridge soil and 25 to 35 percent Cabbart soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Delridge soil is grayish brown loam about 3 inches thick. The next 6 inches also is grayish brown loam. The underlying material is light brownish gray silt loam and loam. Light gray siltstone is at a depth of about 24 inches. The soil is calcareous throughout.

Typically, the surface layer of the Cabbart soil is light brownish gray loam about 3 inches thick. The underlying material is light gray loam. Pale yellow, soft siltstone is at a depth of about 15 inches. In places the soil contains more sand.

Included with these soils in mapping are small areas of Bullock, Parchin, and Tanna soils. These soils make up less than 15 percent of any one mapped area. Bullock and Parchin soils are lower on the landscape than the Delridge soil. They have a sodium affected subsoil. Tanna soils have a dark surface layer and contain more clay in the subsoil than the Delridge soil. They are on the smooth parts of the landscape, generally below the Delridge and Cabbart soils.

Fertility and the content of organic matter are low in the Delridge and Cabbart soils. Available water capacity is low in the Delridge soil and very low in the Cabbart soil. Permeability is moderate in both soils. Runoff is medium or rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

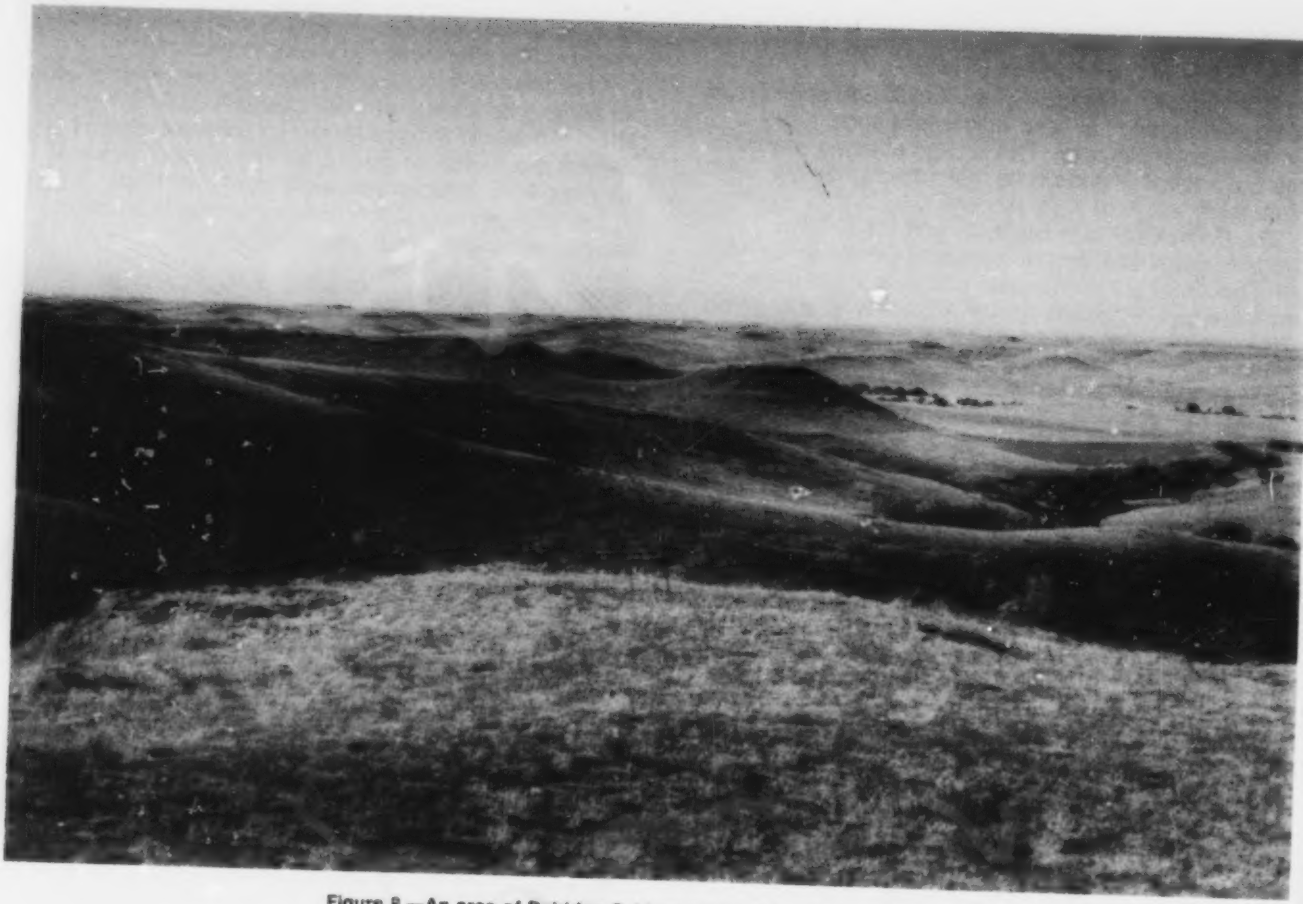

Figure 8.—An area of Delridge-Cabbart loams, 6 to 15 percent slopes.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because they are too steep and because the Cabbart soil is shallow. The less sloping areas of the Delridge soil, however, can be seeded to tame pasture plants or used for environmental plantings.

The capability unit is VIe-3. The Delridge soil is in Thin Upland range site, windbreak suitability group 8; the Cabbart soil is in Shallow range site, windbreak suitability group 10.

EaA—Eapa loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 20 to 175 acres in size.

Typically, the surface layer is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Included with this soil in mapping are small areas of Grail soils in swales. These soils make up less than 10 percent of any one mapped area. They contain more clay in the subsoil than the Eapa soil and are dark to a depth of more than 16 inches.

Fertility is medium and the content of organic matter moderate in the Eapa soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Crested wheatgrass, intermediate wheatgrass, and alfalfa are examples of suitable pasture plants. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Measures that conserve moisture are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

EaB—Eapa loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to 300 acres in size.

Typically, the surface layer is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Included with this soil in mapping are small areas of Delridge and Grail soils. These soils make up less than 10 percent of any one mapped area. The moderately deep Delridge soils are on ridges. Grail soils contain more clay in the subsoil than the Eapa soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium and the content of organic matter moderate in the Eapa soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Crested wheatgrass, intermediate wheatgrass, and alfalfa are examples of suitable pasture plants. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Measures that control erosion and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, farming on the contour, stripcropping, and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

EaC—Eapa loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 10 to 100 acres in size.

Typically, the surface layer is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Included with this soil in mapping are small areas of Delridge, Grail, and Tanna soils. These soils make up less than 10 percent of any one mapped area. The moderately deep Delridge and Tanna soils are slightly higher on the landscape than the Eapa soil. Grail soils contain more clay in the subsoil than the Eapa soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium and the content of organic matter moderate in the Eapa soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass and alfalfa are examples of suitable pasture plants. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Measures that control erosion are the main management needs. Examples are leaving crop residue on the surface, farming on the contour, minimizing tillage, and terracing.

Generally, no major hazards or limitations affect the use of this soil for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IVe-1; Silty range site; windbreak suitability group 3.

EdB—Eapa-Delridge loams, 2 to 6 percent slopes. These well drained, gently sloping soils are on uplands. The deep Eapa soil is on side slopes. The moderately deep Delridge soil is on ridges. Areas are irregular in shape and 10 to 300 acres in size. They are 50 to 60 percent Eapa soil and 20 to 30 percent Delridge soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eapa soil is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Typically, the surface layer of the Delridge soil is grayish brown loam about 3 inches thick. The next 6 inches is grayish brown, friable loam. The underlying material is light brownish gray silt loam and loam. The soil is calcareous throughout. Light gray, calcareous siltstone is at a depth of about 24 inches.

Included with these soils in mapping are small areas of Cabbart and Grail soils. These included soils make up less than 15 percent of any one mapped area. The shallow Cabbart soils are on high ridges. The deep Grail soils contain more clay in the subsoil than the Eapa soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium in the Eapa soil and low in the Delridge soil. The content of organic matter is moderate in the Eapa soil and low in the Delridge soil. Tilth is good in both soils. Available water capacity is high in the Eapa soil and low in the Delridge soil. Permeability is moderate in both soils. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to cultivated crops and to tame pasture and hay, but the high content of lime in the Delridge soil adversely affects the availability of plant nutrients. Crested wheatgrass, intermediate wheatgrass, and alfalfa are examples of suitable pasture plants. Alfalfa, winter wheat, oats, and grain sorghum are the main crops. Measures that control erosion, conserve moisture, and improve fertility are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage. Contour farming, grassed waterways, and terraces also help to control erosion.

These soils are suited to windbreaks and environmental plantings, but the low available water capacity and high content of lime in the Delridge soil are limitations. Windbreaks can be established, but optimum growth is unlikely on the Delridge soil. Planting on the contour helps to control erosion.

The Eapa soil is in capability unit IIIe-1, Silty range site, and windbreak suitability group 3; the Delridge soil is in capability unit IVe-8, Thin Upland range site, and windbreak suitability group 8.

EdC—Eapa-Delridge loams, 6 to 9 percent slopes. These well drained, moderately sloping soils are on uplands. The deep Eapa soil is on the less sloping parts of the landscape. The moderately deep Delridge soil is on ridges and the upper side slopes. Areas are irregular in shape and 10 to 150 acres in size. They are 60 to 70 percent Eapa soil and 20 to 30 percent Delridge soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eapa soil is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Typically, the surface layer of the Delridge soil is grayish brown loam about 3 inches thick. The next 6 inches is grayish brown, friable loam. The underlying material is light brownish gray silt loam and loam. The soil is calcareous throughout. Light gray, calcareous siltstone is at a depth of about 24 inches.

Included with these soils in mapping are small areas of Grail soils. These soils make up less than 20 percent of any one mapped area. They contain more clay in the subsoil than the Eapa soil and are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium in the Eapa soil and low in the Delridge soil. The content of organic matter is moderate in the Eapa soil and low in the Delridge soil. Tilth is good in both soils. Available water capacity is high in the Eapa soil and low in the Delridge soil. Permeability is moderate in both soils. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils are suited to cultivated crops and to tame pasture and hay, but the high content of lime in the Delridge soil adversely affects the availability of plant nutrients. Intermediate wheatgrass and alfalfa are examples of suitable pasture plants. Winter wheat, oats, and grain sorghum are the main crops. Measures that control erosion and improve fertility are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage. Contour farming, grassed waterways, and terraces also help to control erosion.

These soils are suited to windbreaks and environmental plantings, but the low available water capacity and high content of lime in the Delridge soil are limitations. Windbreaks can be established, but optimum growth is unlikely on the Delridge soil. Planting on the contour helps to control erosion.

The Eapa soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 3; the Delridge soil is in capability unit IVe-8, Thin Upland range site, and windbreak suitability group 8.

EgB—Eapa-Grail complex, 2 to 6 percent slopes. These deep, well drained, gently sloping soils are on uplands. The Eapa soil is on the high parts of the landscape. The Grail soil is in swales. Areas are irregular in shape and 10 to 300 acres in size. They are 65 to 75 percent Eapa soil and 20 to 25 percent Grail soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eapa soil is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Typically, the surface layer of the Grail soil is dark grayish brown silt loam about 8 inches thick. The subsoil is brown and pale brown, firm clay about 20 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam and pale brown, calcareous silt loam. It has accumulations of carbonate throughout.

Included with these soils in mapping are small areas of the moderately deep Delridge and Tanna soils. These included soils make up less than 20 percent of any one mapped area. Delridge soils are on ridges. Tanna soils are in positions on the landscape similar to those of the Eapa soil.

Fertility is medium in the Eapa soil and high in the Grail soil. The content of organic matter is moderate in the Eapa soil and high in the Grail soil. Tilth is good in both soils. Available water capacity is high. Permeability is moderate in the Eapa soil and moderately slow in the Grail soil. Runoff is medium on both soils. The shrink-swell potential is moderate in the Eapa soil and high in the Grail soil.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to cultivated crops and to tame pasture and hay. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Crested wheatgrass, intermediate wheatgrass, and alfalfa are examples of suitable pasture plants. Measures that control erosion and conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The Eapa soil is in capability unit IIIe-1, windbreak suitability group 3; the Grail soil is in capability unit IIe-3, windbreak suitability group 1. Both soils are in Silty range site.

EgC—Eapa-Grail complex, 6 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands. The Eapa soil is higher on the landscape than the Grail soil. The Grail soil is in swales. Areas are irregular in shape and 10 to 100 acres in size. They are 65 to 75 percent Eapa soil and 20 to 25 percent Grail soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Eapa soil is grayish brown loam about 4 inches thick. The subsoil is about 33 inches thick. The upper part is grayish brown and brown, friable clay loam, and the lower part is light brownish gray, calcareous, very friable loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous loam.

Typically, the surface layer of the Grail soil is dark grayish brown silt loam about 8 inches thick. The subsoil is brown and pale brown, firm clay about 20 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam and pale brown, calcareous silt loam. It has accumulations of carbonate throughout.

Included with these soils in mapping are small areas of the moderately deep Delridge and Tanna soils. These included soils make up less than 20 percent of any one mapped area. Delridge soils are on ridges and the upper side slopes. Tanna soils are in positions on the landscape similar to those of the Eapa soil.

Fertility is medium in the Eapa soil and high in the Grail soil. The content of organic matter is moderate in the Eapa soil and high in the Grail soil. Tilth is good in both soils. Available water capacity is high. Permeability is moderate in the Eapa soil and moderately slow in the Grail soil. Runoff is medium on both soils. The shrink-swell potential is moderate in the Eapa soil and high in the Grail soil.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils are suited to cultivated crops and to tame pasture and hay. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Alfalfa and intermediate wheatgrass are suitable pasture plants. Measures that control erosion are the main management needs. Examples are minimizing tillage, terracing, farming on the contour, establishing grassed waterways, and leaving crop residue on the surface.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The Eapa soil is in capability unit IVe-1; the Grail soil is in capability unit IIIe-1. Both soils are in Silty range site and windbreak suitability group 3.

GaA—Gerdrum loam, 0 to 4 percent slopes. This deep, well drained, nearly level and gently sloping soil is on uplands and terraces. Areas are irregular in shape and 20 to 500 acres in size.

Typically, the surface layer is light brownish gray loam about 4 inches thick. The subsoil is about 16 inches thick. The upper part is grayish brown, firm clay loam and clay, and the lower part is light brownish gray, firm, calcareous clay loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has gypsum and other salts throughout.

Included with this soil in mapping are small areas of Assinniboine, Delridge, Loburn, and Twilight soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Assinniboine, Delridge, and Twilight soils do not have a sodium affected subsoil. Loburn soils have a surface soil that is thicker than that of the Gerdrum soil. Assinniboine and Loburn soils are slightly higher on the landscape than the Gerdrum soil. Delridge and Twilight soils are on low ridges. Slickspots have a dispersed surface and are high in content of salts. They occur as areas intermingled with areas of the Gerdrum soil on the low parts of the landscape.

Fertility and the content of organic matter are low in the Gerdrum soil. Tilth is poor. This soil has a sodium affected subsoil that restricts the penetration of roots. Available water capacity is moderate. Permeability is slow. Runoff is slow or medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. The sodium affected subsoil limits productivity. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay, but the sodium affected subsoil is a limitation. Intermediate wheatgrass and pubescent wheatgrass are examples of suitable pasture plants. Winter wheat, oats, and grain sorghum are the main crops. Measures that conserve moisture and improve tilth are the main management needs. Examples are including grasses and legumes in the cropping system and leaving crop residue on the surface. Chiseling or subsoiling increases the rate of water intake and improves tilth.

This soil is suited to windbreaks and environmental plantings, but the dense claypan subsoil severely limits root penetration. Optimum growth, survival, and vigor are unlikely.

The capability unit is IVs-3; Claypan range site; windbreak suitability group 9.

Gc—Glenberg fine sandy loam. This deep, well drained, nearly level, calcareous soil is on flood plains. It is subject to rare flooding, which lasts for brief periods. Areas are irregular in shape and 20 to 500 acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches is grayish brown, stratified fine sandy loam and loamy fine sand. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Bankard and Lohmiller soils. These soils make up less than 15 percent of any one mapped area. The sandy Bankard soils are adjacent to the stream channel. The silty Lohmiller soils are farther from the stream channel than the Glenberg soil and are slightly higher on the flood plain.

Fertility and the content of organic matter are low in the Glenberg soil. Tilth is fair. Available water capacity is moderate. Permeability is moderately rapid. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, wind erosion is a hazard if the range is overgrazed.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa and oats are the main crops. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Some areas are used for winter wheat. Measures that control wind erosion and conserve moisture are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and stripcropping. This soil is suited to irrigation.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Preparing the soil for planting in the spring helps to control wind erosion.

The capability unit is IIIe-4; Loamy Overflow range site; windbreak suitability group 1.

Gr—Grail silt loam. This deep, well drained, nearly level soil is in swales on uplands. It is frequently flooded for brief periods. Areas are long and narrow and are 10 to 100 acres in size.

Typically, the surface soil is dark grayish brown silt loam about 8 inches thick. The subsoil is brown and pale brown, firm clay about 20 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam and pale brown, calcareous silt loam. It has accumulations of carbonate throughout.

Included with this soil in mapping are small areas of Assinniboine, Eapa, and Tanna soils. These soils make up less than 10 percent of any one mapped area. They are slightly higher on the landscape than the Grail soil. Also, Assinniboine and Eapa soils contain less clay in the subsoil. Tanna soils are 20 to 40 inches deep over soft bedrock.

Fertility and the content of organic matter are high in the Grail soil. Tilth is good. Available water capacity is high. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass, smooth bromegrass, and alfalfa are examples of suitable pasture plants. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Measures that conserve moisture during dry periods are the main management needs. Minimizing tillage and leaving crop residue on the surface conserve moisture.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well.

The capability unit is IIc-3; Loamy Overflow range site; windbreak suitability group 1.

Hb—Havre loam. This deep, well drained, nearly level, calcareous soil is on flood plains. It is subject to rare flooding, which lasts for brief periods. Areas generally are long and narrow and are 20 to 350 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray, stratified, calcareous loam, fine sandy loam, and very fine sandy loam. In places the surface layer is darker.

Included with this soil in mapping are small areas of Lohmiller soils. These soils make up less than 15 percent of any one mapped area. They contain more silt and clay throughout than the Havre soil. Also, they are farther from the stream channel.

Fertility and the content of organic matter are low in the Havre soil. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is slow.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay, but the high content of lime in the surface layer adversely affects the availability of plant nutrients. Smooth bromegrass, intermediate wheatgrass, crested wheatgrass, and alfalfa are examples of suitable pasture plants. Alfalfa, oats, and grain sorghum are the main crops. Some areas are used for winter wheat. Measures that control erosion, improve fertility, and conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system. This soil is suited to irrigation.

No major hazards or limitations affect the use of this soil for range. Some areas have a sparse stand of deciduous trees and shrubs. These native trees and shrubs provide protection for livestock in winter.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIIc-2; Loamy Overflow range site; windbreak suitability group 1.

Hc—Havre loam, channeled. This deep, well drained, nearly level, calcareous soil is on flood plains that are dissected by narrow channels and partly filled old stream meanders. It is frequently flooded for brief periods. Areas generally are long and narrow and are 20 to 700 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 5 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous, stratified loam, fine sandy loam, and very fine sandy loam. In places the surface layer is darker.

Included with this soil in mapping are small areas of the silty Lohmiller soils. These soils make up less than 10 percent of any one mapped area. They contain more clay throughout than the Havre soil. They are adjacent to the uplands.

Fertility and the content of organic matter are low in the Havre soil. Tilth is good. Available water capacity is moderate or high. Permeability is moderate. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Some areas near the stream channel support deciduous trees and shrubs (fig. 9). These trees and shrubs provide protection for wildlife and livestock in winter. Although the soil is frequently flooded, the additional water is beneficial. Pools of water in some areas of the channel provide temporary watering places for livestock and wildlife.

This soil generally is unsuited to cultivated crops because it is dissected into many small tracts by the channels and is frequently flooded. It is suited to tame pasture and hay, but harvesting hay is difficult because of the meandering channels. Alfalfa, intermediate wheatgrass, crested wheatgrass, and smooth bromegrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Because of the meandering channels, trees generally cannot be planted by machine. They can be planted by hand.

The capability unit is VIw-1; Loamy Overflow range site; windbreak suitability group 1.

Figure 9.—Native trees along a channel in an area of Havre loam, channeled.

He—Heil silty clay loam. This deep, poorly drained, level soil is in depressions in the uplands. It is ponded during wet periods. Areas are 5 to 40 acres in size and are circular or oval.

Typically, the surface layer is light gray silty clay loam about 3 inches thick. The subsoil is dark gray and gray, very firm clay about 25 inches thick. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is gray, calcareous clay. It has accumulations of carbonate throughout.

Fertility is low and the content of organic matter medium. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. Available water capacity is moderate. Permeability is very slow. A seasonal high water table is within a depth of 1 foot in the spring. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction and ponding are problems. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and environmental plantings because of the seasonal wetness. Artificial drainage generally is not feasible because suitable outlets are not available. Western wheatgrass is the best species for planting if cultivated areas are seeded to grass.

The capability unit is VIs-3; Closed Depression range site; windbreak suitability group 10.

HfB—Hisle-Slickspots complex, 0 to 4 percent slopes. This map unit occurs as areas of a moderately deep, well drained, nearly level and gently sloping Hisle soil intermingled with Slickspots. It is on uplands. The Hisle soil is on the high parts of the landscape. The

Slickspots are in slight depressions. Areas are irregular in shape and 10 to 90 acres in size. They are 60 to 70 percent Hisle soil and 25 to 35 percent Slickspots. The Hisle soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Hisle soil is light brownish gray silt loam about 1 inch thick. The subsoil is about 10 inches thick. It is grayish brown and light brownish gray silty clay and clay. It is calcareous in the lower part. The underlying material is light brownish gray and light gray, calcareous clay. It has accumulations of salts in the lower part. Light gray, calcareous shale is at a depth of about 28 inches.

The Slickspots occur as slightly depressed, barren areas that have a puddled or slick surface. Visible accumulations of salts are at or near the surface. The soil material to a depth of about 28 inches is massive clay.

Included with the Hisle soil and the Slickspots in mapping are small areas of the clayey Swanboy soils. These soils make up less than 15 percent of any one mapped area. They do not have a sodium affected subsoil. They are in positions on the landscape similar to those of the Hisle soil.

Fertility and the content of organic matter are low in the Hisle soil. Tilth is poor. This soil has a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is very low. Permeability is very slow. Runoff is slow or medium. The shrink-swell potential is very high.

Nearly all of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. The Slickspots generally support little or no vegetation, but they do support a sparse stand of weeds and pricklypear during wet periods.

This map unit generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The sodium affected subsoil of the Hisle soil and the salts in the Slickspots are limitations.

The Hisle soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or a windbreak suitability group.

KyA—Kyle clay, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 30 to 400 acres in size.

Typically, the surface layer is grayish brown clay about 2 inches thick. The subsoil is olive gray and light olive gray, firm, calcareous clay about 38 inches thick. It has visible crystals of gypsum and other salts in the lower part. The underlying material to a depth of 60 inches is light olive gray, calcareous clay. It has visible crystals of gypsum and other salts throughout. In places the depth to shale is 20 to 40 inches. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of Swanboy soils. These soils make up less than 10 percent of any one mapped area. They have visible salts near the surface. They are in positions on the landscape similar to those of the Kyle soil.

Fertility and the content of organic matter are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Crested wheatgrass, intermediate wheatgrass, and alfalfa are examples of suitable species for tame pasture and hay. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Measures that improve tilth and conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely.

The capability unit is IVs-3; Clayey range site; windbreak suitability group 4C.

KyB—Kyle clay, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are irregular in shape and 20 to 300 acres in size.

Typically, the surface layer is grayish brown clay about 2 inches thick. The subsoil is olive gray and light olive gray, firm, calcareous clay about 38 inches thick. It has visible crystals of gypsum and other salts in the lower part. The underlying material to a depth of 60 inches is light olive gray, calcareous clay. In places the depth to shale is 20 to 40 inches. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of Samsil and Swanboy soils. These soils make up less than 10 percent of any one mapped area. Samsil soils are 10 to 20 inches deep over shale. They are on ridges. Swanboy soils have visible salts near the surface. They are in positions on the landscape similar to those of the Kyle soil.

Fertility and the content of organic matter are low in the Kyle soil. Tilth is poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Crested wheatgrass and alfalfa are examples of suitable pasture plants. Winter wheat, oats, alfalfa, and grain sorghum are the main crops. Measures that control erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface and minimizing tillage. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

La—Lardell fine sandy loam. This deep, somewhat poorly drained, nearly level soil is on flood plains. It is subject to rare flooding, which lasts for brief periods. Areas are long and narrow and are 10 to 450 acres in size.

Typically, the surface layer is light gray fine sandy loam about 1 inch thick. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, stratified clay loam, sandy clay loam, and sandy loam. The soil is calcareous and has many crystals of salts throughout.

Included with this soil in mapping are small areas of Bullock soils and Slickspots. These inclusions make up less than 10 percent of any one mapped area. They are slightly higher on the landscape than the Lardell soil. The well drained Bullock soils have a sodium affected subsoil. Slickspots have a dispersed surface layer. They support little or no vegetation.

Fertility and the content of organic matter are low in the Lardell soil. Tilth is poor. Available water capacity is low. The high content of salts adversely affects the growth of most plants. Permeability is slow. A seasonal high water table is at a depth of 1.5 to 3.0 feet. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. An excess of salts and compaction are problems. Range management should favor salt tolerant species. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Many areas are potential sites for excavated ponds.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the high content of salts.

The capability unit is VIw-3; Saline Lowland range site; windbreak suitability group 10.

LaB—Lawther silty clay, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. When dry, it is characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Areas are 20 to 600 acres in size and irregular in shape. Slopes generally are long and smooth.

Typically, the surface layer is dark grayish brown silty clay about 6 inches thick. The subsoil is about 20 inches thick. It is grayish brown, calcareous, firm clay and silty clay. It has accumulations of carbonate in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay. It has accumulations of carbonate and gypsum crystals throughout. In places shale is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Absher and Yawdim soils. These soils make up less than 15 percent of any one mapped area. Absher soils have a sodium affected subsoil. They are in small pits and depressions. Yawdim soils are 10 to 20 inches deep over shale. They are on ridges.

Fertility is medium and the content of organic matter moderate in the Lawther soil. Tilth is poor. Available water capacity is moderate. Permeability is slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass, crested wheatgrass, and alfalfa are examples of suitable pasture plants. Winter wheat, oats, grain sorghum, and alfalfa are the main crops. Measures that conserve moisture, improve tilth, and control erosion are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

LbE—Lismas clay, 15 to 40 percent slopes. This shallow, well drained, moderately steep and steep soil is on uplands. Areas are irregular in shape and 20 to 300 acres in size.

Typically, the surface layer is light olive gray clay about 3 inches thick. The underlying material is light olive gray clay and shaly clay. Light olive gray shale is at a depth of about 11 inches.

Included with this soil in mapping are small areas of Pierre and Winler soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. Pierre and Winler soils are on the smoother, less sloping parts of the landscape. They are 20 to 40 inches deep over shale. The Rock outcrop is shale bedrock. It is on the steep ridges and upper side slopes.

Fertility and the content of organic matter are low in the Lismas soil. Available water capacity is very low. Permeability is very slow. Runoff is rapid. The shrink-swell potential is very high.

All of the acreage supports native grasses and is used for grazing. Water erosion is a hazard on this moderately steep and steep soil unless an adequate plant cover is maintained. Establishing vegetation is difficult in denuded areas.

This soil is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIIe-5; Shallow Dense Clay range site; windbreak suitability group 10.

LcA—Loburn-Gerdrum complex, 0 to 3 percent slopes. These deep, well drained, nearly level soils are on uplands and terraces. The Loburn soil is on the higher parts of the landscape. The Gerdrum soil is on flats. Areas are irregular in shape and 30 to 400 acres in size. They are 60 to 70 percent Loburn soil and 25 to 35 percent Gerdrum soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Loburn soil is grayish brown loam about 3 inches thick. The subsurface layer is light brownish gray loam about 5 inches thick. The subsoil is about 28 inches thick. The upper part is brown, firm clay. The lower part is light brownish gray, firm, calcareous silty clay loam and clay loam. It has accumulations of carbonate and gypsum crystals. The underlying material to a depth of 60 inches is light brownish gray, calcareous sandy clay loam. It has accumulations of carbonate and gypsum and other salts throughout.

Typically, the surface layer of the Gerdrum soil is light brownish gray loam about 4 inches thick. The subsoil is about 16 inches thick. The upper part is grayish brown, firm clay loam and clay, and the lower part is light brownish gray, firm, calcareous clay loam that has accumulations of carbonate. The underlying material to a depth of 60 inches is light brownish gray, calcareous clay loam. It has gypsum and other salts throughout.

Included with these soils in mapping are small areas of Assinniboine, Delridge, and Savo soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Assinniboine and Savo soils are in positions on the landscape similar to those of the Loburn and Gerdrum soils. Delridge soils are on ridges. Assinniboine, Delridge, and Savo soils do not have a sodium affected subsoil. Slickspots have a dispersed surface and have a high content of salts throughout. They are in small pits and depressions.

Fertility and the content of organic matter are low in the Loburn and Gerdrum soils. Tilth is poor. These soils have a sodium affected subsoil that restricts the penetration of plant roots. Available water capacity is moderate. Permeability is slow in the Gerdrum soil and very slow in the Loburn soil. Runoff is slow or medium on both soils. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

These soils are suited to cultivated crops and to tame pasture and hay, but the clayey subsoil can restrict the penetration of plant roots. Crested wheatgrass and western wheatgrass are examples of suitable pasture plants. The best suited crops are those that are tolerant of drought and sodium salts. Alfalfa, oats, and winter wheat are the main crops. Measures that conserve moisture and improve tilth and fertility are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Chiseling or subsoiling increases the rate of water intake and improves tilth.

These soils are poorly suited to windbreaks and environmental plantings because the sodium affected subsoil restricts the penetration of plant roots. Trees and shrubs can be established, but optimum survival, growth, and vigor are unlikely.

The Loburn soil is in capability unit IVs-2; the Gerdrum soil is in capability unit IVs-3. Both soils are in Claypan range site and windbreak suitability group 9.

Ld—Lohmiller silty clay loam. This deep, well drained, nearly level, calcareous soil is on flood plains. It is subject to rare flooding, which lasts for brief periods. Areas are irregular in shape and 20 to 800 acres in size.

Typically, the surface layer is grayish brown, calcareous silty clay loam about 4 inches thick. The underlying material to a depth of 60 inches is grayish brown and light brownish gray, stratified, calcareous clay loam, clay, silty clay loam, and sandy loam.

Included with this soil in mapping are small areas of Bankard, Glenberg, and Kyle soils. These soils make up less than 10 percent of any one mapped area. Bankard and Glenberg soils are lower on the flood plains and closer to the stream channel than the Lohmiller soil. Also, they contain more sand and less clay throughout.

Kyle soils are not stratified and contain more clay throughout than the Lohmiller soil. They are on foot slopes near the uplands.

Fertility and the content of organic matter are low in the Lohmiller soil. Tilth is fair. Available water capacity is moderate or high. Permeability is moderately slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass, smooth bromegrass, and alfalfa are examples of suitable pasture plants. Alfalfa, oats, and grain sorghum are the main crops. Winter wheat is grown in some of the larger areas. Measures that conserve moisture are the main management needs. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIIc-2; Loamy Terrace range site; windbreak suitability group 1.

Lg—Lohmiller silty clay loam, channeled. This deep, well drained, nearly level, calcareous soil is on flood plains that are dissected by narrow channels. It is frequently flooded during wet periods. Areas are long and narrow and are 20 to more than 500 acres in size.

Typically, the surface layer is grayish brown, calcareous silty clay loam about 4 inches thick. The underlying material to a depth of 60 inches is grayish brown and light brownish gray, stratified, calcareous loam, clay loam, clay, and sandy loam. In some areas the soil contains more clay throughout. On some scarps slopes are as much as 6 percent.

Included with this soil in mapping are small areas of Havre soils. These soils make up less than 10 percent of any one mapped area. They contain less clay throughout than the Lohmiller soil. Also, they are slightly lower on the flood plain.

Fertility and the content of organic matter are low in the Lohmiller soil. Tilth is fair. Available water capacity is moderate or high. Permeability is moderately slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Although the soil is frequently flooded, the additional water is beneficial. Pools of water in some areas of the channel provide temporary watering places for livestock and wildlife. In some areas deciduous trees and shrubs provide protection for livestock and wildlife.

This soil generally is unsuited to cultivated crops because it is dissected into small tracts by the channels and is subject to flooding in the spring. It is suited to tame pasture and hay, but harvesting hay is difficult because of the channeled landscape. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. They can be planted by hand. Because of the meandering channels, however, they generally cannot be planted by machine.

The capability unit is VIw-1; Loamy Overflow range site; windbreak suitability group 1.

NaD—Nihill-Attewan complex, 4 to 20 percent slopes. These deep, well drained, gently sloping to strongly sloping soils are on terraces. The Nihill soil generally is on terrace scarps. It is shallow over very gravelly sand. The Attewan soil generally is on the slightly higher, less sloping parts of the landscape. It is moderately deep over gravelly loamy sand. Areas are long and narrow and are 15 to more than 100 acres in size. They are 50 to 65 percent Nihill soil and 25 to 35 percent Attewan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nihill soil is grayish brown, calcareous gravelly loam about 4 inches thick. The underlying material to a depth of 60 inches is pale brown and brown, calcareous very gravelly sandy loam.

Typically, the surface layer of the Attewan soil is grayish brown loam about 4 inches thick. The subsoil is yellowish brown and light brownish gray, friable loam about 12 inches thick. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous loam. Pale brown, calcareous very gravelly loamy sand is at a depth of about 28 inches.

Included with these soils in mapping are small areas of Blackhall, Cabbart, and Nunn soils. These included soils make up less than 20 percent of any one mapped area. Blackhall and Cabbart soils are below the Nihill and Attewan soils on the landscape. They are 10 to 20 inches deep over soft bedrock. The deep Nunn soils contain more clay in the subsoil than the Attewan soil. Also, they are slightly higher on the landscape.

Fertility is low in the Nihill soil and medium in the Attewan soil. The content of organic matter is low in the Nihill soil and moderate in the Attewan soil. Available water capacity is very low in the Nihill soil and low in the Attewan soil. Permeability is moderately rapid in the Nihill soil. It is moderate in the upper part of the Attewan soil and rapid in the lower part. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Productivity is limited because the Nihill soil is droughty. Water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails.

Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

The Nihill soil generally is unsuited and the Attewan soil suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The use of this map unit is determined by the suitability of the Nihill soil. The droughtiness of both soils is a limitation. Environmental plantings can be established on the Attewan soil, but optimum growth and survival are unlikely.

The capability unit is VIs-4. The Nihill soil is in Thin Upland range site, windbreak suitability group 10; the Attewan soil is in Silty range site, windbreak suitability group 6G.

NuA—Nunn clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces. Areas are irregular in shape and 20 to 700 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The subsoil is about 29 inches thick. It is dark grayish brown and grayish brown, friable and firm clay loam and clay. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is grayish brown clay loam. It has accumulations of carbonate throughout.

Included with this soil in mapping are small areas of Gerdrum and Satanta soils. These soils make up less than 15 percent of any one mapped area. Gerdrum soils have a sodium affected subsoil. They generally are along drainageways. Satanta soils have less clay in the subsoil than the Nunn soil. They are in positions on the landscape similar to those of the Nunn soil.

Fertility is medium and the content of organic matter moderate in the Nunn soil. Tilth is good. Available water capacity is high. Permeability is moderately slow. Runoff is slow. The shrink-swell potential is high in the subsoil.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Measures that conserve moisture are the main management needs. Examples are leaving crop residue on the surface and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Clayey range site; windbreak suitability group 3.

NuB—Nunn clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to 300 acres in size.

Typically, the surface layer is grayish brown clay loam about 7 inches thick. The subsoil is about 29 inches thick. It is dark grayish brown and grayish brown, friable and firm clay loam and clay. In the lower part it is calcareous and has accumulations of carbonate. The underlying material to a depth of 60 inches is grayish brown clay loam. It has accumulations of carbonate throughout.

Included with this soil in mapping are small areas of Gerdrum and Satanta soils. These soils make up less than 15 percent of any one mapped area. Gerdrum soils have a sodium affected subsoil. They generally are along drainageways. Satanta soils have less clay in the subsoil than the Nunn soil. They are in positions on the landscape similar to those of the Nunn soil.

Fertility is medium and the content of organic matter moderate in the Nunn soil. Tilth is good. Available water capacity is high. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is high in the subsoil.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and crested wheatgrass are examples of suitable pasture plants. Measures that conserve moisture and control erosion are the main management needs. Examples are leaving crop residue on the surface and minimizing tillage. Contour farming and terraces also help to control erosion.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IIIe-1; Clayey range site; windbreak suitability group 3.

PbB—Parchin-Bullock fine sandy loams, 2 to 6 percent slopes. These moderately deep, well drained, gently sloping soils are on uplands. The Parchin soil is on slight rises. The Bullock soil generally is in small pits and depressions. Areas are irregular in shape and 10 to 350 acres in size. They are 65 to 70 percent Parchin soil and 25 to 30 percent Bullock soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Parchin soil is brown fine sandy loam about 6 inches thick. The subsurface layer is pale brown fine sandy loam about 6 inches thick. The subsoil is brown, friable sandy clay loam about 20 inches thick. In the lower part it is calcareous and has visible crystals of gypsum and other salts. Light brownish gray, calcareous, soft sandstone is at a depth of about 32 inches. In places the depth to sandstone is more than 40 inches. In some areas the subsoil contains more clay.

Typically, the surface layer of the Bullock soil is grayish brown fine sandy loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is brown, friable sandy clay loam. The lower part is grayish brown, friable, calcareous sandy loam. It has visible crystals of gypsum and other salts. The underlying material is light brownish gray, calcareous sandy loam that has visible crystals of gypsum and other salts. Light gray, soft sandstone interbedded with thin layers of siltstone is at a depth of about 22 inches. In places the subsoil contains more clay. In some areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Blackhall, Marmarth, and Twilight soils and Slickspots. These inclusions make up less than 20 percent of any one mapped area. Blackhall, Marmarth, and Twilight soils are on the convex parts of the landscape, generally above the Parchin and Bullock soils. They do not have a sodium affected subsoil. Slickspots have a dispersed surface and have a high content of salts throughout. They are in small pits and depressions.

Fertility and the content of organic matter are low in the Parchin and Bullock soils. Tilth is fair in the Parchin soil and poor in the Bullock soil. Both soils have a sodium affected subsoil that restricts root penetration. Available water capacity is low. Permeability is slow or very slow. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem on the Bullock soil. Wind erosion is a hazard in overgrazed areas of the Parchin soil. Range seeding may be needed on some sites.

This map unit is suited to cultivated crops and to tame pasture and hay, but crop growth is severely restricted on the Parchin soil because of the dense, sodium affected subsoil. No crops grow well on the Bullock soil. Crested wheatgrass and western wheatgrass are examples of suitable pasture plants. Alfalfa and winter wheat are the main crops. Measures that conserve moisture and improve tilth are the main management needs. Examples are leaving crop residue on the surface and including grasses and legumes in the cropping system. Chiseling or subsoiling improves tilth and increases the rate of water intake.

The Parchin soil is suited and the Bullock soil generally unsuited to windbreaks and environmental plantings. The sodium affected subsoil restricts the penetration of plant roots. Trees and shrubs can be established on the Parchin soil, but optimum survival, growth, and vigor are unlikely. No trees or shrubs grow well on the Bullock soil.

The Parchin soil is in capability unit IVe-12, Claypan range site, and windbreak suitability group 9; the Bullock soil is in capability unit VIs-3, Thin Claypan range site, and windbreak suitability group 10.

PeB—Pierre clay, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 10 to 150 acres in size.

Typically, the surface layer is grayish brown clay about 3 inches thick. The subsoil is olive gray, firm clay about 12 inches thick. The underlying material is olive gray clay and shaly clay. Gray shale is at a depth of about 28 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Hisle, Lismas, and Samsil soils. These soils make up less than 10 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are on foot slopes. Lismas and Samsil soils are 10 to 20 inches deep to shale. They are on ridges.

Fertility and the content of organic matter are low in the Pierre soil. Tilth is poor. Available water capacity is very low or low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing and hay. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa and crested wheatgrass are examples of suitable pasture plants. Alfalfa, oats, winter wheat, and grain sorghum are the main crops. Measures that conserve moisture, control erosion, and improve tilth are the main management needs. Chiseling or subsoiling improves tilth and increases the rate of water intake.

This soil is suited to windbreaks and environmental plantings. It takes in water slowly, however, and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-3; Clayey range site; windbreak suitability group 4C.

PeC—Pierre clay, 6 to 15 percent slopes. This moderately deep, well drained, moderately sloping and strongly sloping soil is on uplands. Areas are irregular in shape and 10 to 150 acres in size.

Typically, the surface layer is grayish brown clay about 3 inches thick. The subsoil is olive gray, firm clay about 12 inches thick. The underlying material is olive gray clay and shaly clay. Gray shale is at a depth of about 28 inches. In places the depth to shale is more than 40 inches.

Included with this soil in mapping are small areas of Hisle, Lismas, and Samsil soils. These soils make up less than 10 percent of any one mapped area. Hisle soils have a sodium affected subsoil. They are on foot slopes. Lismas and Samsil soils are 10 to 20 inches deep to shale. They are on ridges and the upper side slopes.

Fertility and the content of organic matter are low in the Pierre soil. Tilth is poor. Available water capacity is very low or low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing and hay. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil is too steep for cultivated crops. It is suitable, however, for tame pasture and hay. Pubescent wheatgrass and western wheatgrass are examples of suitable pasture plants.

This soil is suited to windbreaks and environmental plantings; however, it takes in water slowly and the clayey subsoil can restrict the penetration of plant roots. Windbreaks can be established, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is VIe-4; Clayey range site; windbreak suitability group 4C.

PlE—Pierre-Lismas clays, 15 to 40 percent slopes. These well drained, moderately steep and steep soils are on uplands. The moderately deep Pierre soil is on smooth side slopes. The shallow Lismas soil is on ridges and the upper side slopes. Areas are irregular in shape and 30 to 800 acres in size. They are 60 to 70 percent Pierre soil and 25 to 30 percent Lismas soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is grayish brown clay about 3 inches thick. The subsoil is olive gray, firm clay about 12 inches thick. The underlying material is olive gray clay and shaly clay. Gray shale is at a depth of about 28 inches.

Typically, the surface layer of the Lismas soil is light olive gray clay about 3 inches thick. The underlying material is light olive gray clay and shaly clay. Light olive gray shale is at a depth of about 11 inches.

Included with these soils in mapping are small areas of Kyle and Winler soils. These included soils make up less than 15 percent of any one mapped area. Kyle soils are more than 40 inches deep to shale. They are on the low parts of the landscape. The moderately deep Winler soils are shallower to visible salts than the Pierre soil. They are in positions on the landscape similar to those of the Pierre soil.

Fertility and the content of organic matter are low in the Pierre and Lismas soils. Available water capacity is very low or low in the Pierre soil and very low in the Lismas soil. Permeability is very slow in both soils. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for range. Water erosion is a hazard on these moderately steep and steep soils unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws; however, seepage could be a problem.

These soils are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Pierre soil is in capability unit VIe-4, Clayey range site; the Lismas soil is in capability unit VIIe-5, Shallow Dense Clay range site. Both soils are in windbreak suitability group 10.

PsC—Pierre-Samsil clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Pierre soil is on smooth side slopes. The shallow Samsil soil is on ridges and the upper side slopes. Areas are irregular in shape and 20 to 500 acres in size. They are 50 to 60 percent Pierre soil and 30 to 40 percent Samsil soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Pierre soil is grayish brown clay about 3 inches thick. The subsoil is olive gray, firm clay about 12 inches thick. The underlying material is olive gray clay and shaly clay. Gray shale is at a depth of about 28 inches.

Typically, the surface layer of the Samsil soil is grayish brown clay about 2 inches thick. The next 5 inches also is grayish brown clay. The underlying material is grayish brown shaly clay. Light brownish gray shale is at a depth of 13 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Kyle and Lohmiller soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The deep Kyle soils are on foot slopes in the uplands. The stratified, silty Lohmiller soils are on narrow flood plains.

Fertility and the content of organic matter are low in the Pierre and Samsil soils. Available water capacity is very low or low in the Pierre soil and very low in the Samsil soil. Permeability is very slow in the Pierre soil and slow in the Samsil soil. Runoff is rapid on both soils. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for range. Water erosion is a hazard on these moderately sloping and strongly sloping soils unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Sites for stock water impoundments are available in some of the draws; however, seepage could be a problem.

These soils are too steep for cultivated crops, but the Pierre soil is suited to tame pasture and hay. Pubescent wheatgrass and western wheatgrass are examples of suitable pasture plants.

The Pierre soil is suited and the Samsil soil generally unsuited to windbreaks and environmental plantings. The Pierre soil takes in water slowly, and its clayey subsoil can restrict the penetration of plant roots. Environmental plantings can be established on the Pierre soil, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The Pierre soil is in capability unit VIe-4, Clayey range site, and windbreak suitability group 4C; the Samsil soil is in capability unit VIe-12, Shallow Clay range site, and windbreak suitability group 10.

RoE—Rock outcrop-Cabbart-Bullock complex, 15 to 40 percent slopes. This map unit occurs as areas of Rock outcrop intermingled with areas of moderately steep and steep Cabbart and Bullock soils. The Rock outcrop is on buttes and on steep side slopes along entrenched drainageways. The shallow Cabbart soil is on ridges. The moderately deep, sodium affected Bullock soil is on foot slopes and the less sloping parts of the landscape. Areas are irregular in shape and 30 to 300 acres in size. They are 50 to 60 percent Rock outcrop, 20 to 30 percent Cabbart soil, and 20 to 25 percent Bullock soil. The Rock outcrop and the two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

The Rock outcrop is weakly cemented to strongly cemented sandstone, siltstone, and shale. It does not support vegetation.

Typically, the surface layer of the Cabbart soil is light brownish gray loam about 3 inches thick. The underlying material is light gray loam. Pale yellow, soft siltstone is at a depth of about 15 inches. The soil is calcareous throughout. In places the content of sand is higher.

Typically, the surface layer of the Bullock soil is grayish brown fine sandy loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is brown, friable sandy clay loam. The lower part is grayish brown, friable, calcareous sandy loam. It has visible crystals of gypsum and other salts. The underlying material is light brownish gray, calcareous sandy loam that has visible crystals of gypsum and other salts. Light gray, soft sandstone interbedded with thin layers of siltstone is at a depth of about 22 inches. In places the subsoil contains more clay. In some areas the depth to bedrock is more than 40 inches.

Included with the Rock outcrop and the Cabbart and Bullock soils in mapping are small areas of Delridge soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. The moderately deep Delridge soils do not have a sodium affected subsoil. They are in positions on the landscape similar to those of the Cabbart soil. Slickspots have a dispersed surface and have a high content of salts throughout. They are in small pits and depressions.

Fertility and the content of organic matter are low in the Bullock and Cabbart soils. Available water capacity i low in the Bullock soil and very low in the Cabbart soil. Permeability is moderate in the Cabbart soil and slow or very slow in the Bullock soil. Runoff is rapid on both soils. The shrink-swell potential is moderate.

The Rock outcrop does not support grazable vegetation. In all areas the Cabbart and Bullock soils support native grasses and are used for grazing. Water erosion is a hazard. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying. Reestablishing vegetation is difficult in denuded areas.

This map unit is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope, the Rock outcrop, and the sodium affected subsoil in the Bullock soil.

The Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site or a windbreak suitability group; the Cabbart soil in capability unit VIIe-4, Shallow range site, and windbreak suitability group 10; the Bullock soil is in capability unit VIIe-7, Thin Claypan range site, and windbreak suitability group 10.

SaD—Samsil clay, 6 to 25 percent slopes. This shallow, well drained, moderately sloping to moderately steep soil is on uplands. Areas are irregular in shape and 80 to 2,000 acres in size.

Typically, the surface layer is grayish brown clay about 2 inches thick. The next 5 inches also is grayish brown clay. The underlying material is grayish brown shaly clay. Light brownish gray shale is at a depth of about 13 inches. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Lohmiller, Kyle, and Pierre soils and Rock outcrop. These inclusions make up less than 15 percent of any one mapped area. The stratified, silty Lohmiller soils are on narrow flood plains. The moderately deep Pierre and deep Kyle soils are on foot slopes. The Rock outcrop generally is on the steep upper side slopes along drainageways.

Fertility and the content of organic matter are low in the Samsil soil. Available water capacity is very low. Permeability is slow. Runoff is medium or rapid. The shrink-swell potential is very high.

Nearly all of the acreage supports native grasses and is used for range. Scattered clumps of Rocky Mountain juniper are common (fig. 10). Water erosion is a hazard on this moderately sloping to moderately steep soil unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This soil is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIe-12; Shallow Clay range site; windbreak suitability group 10.

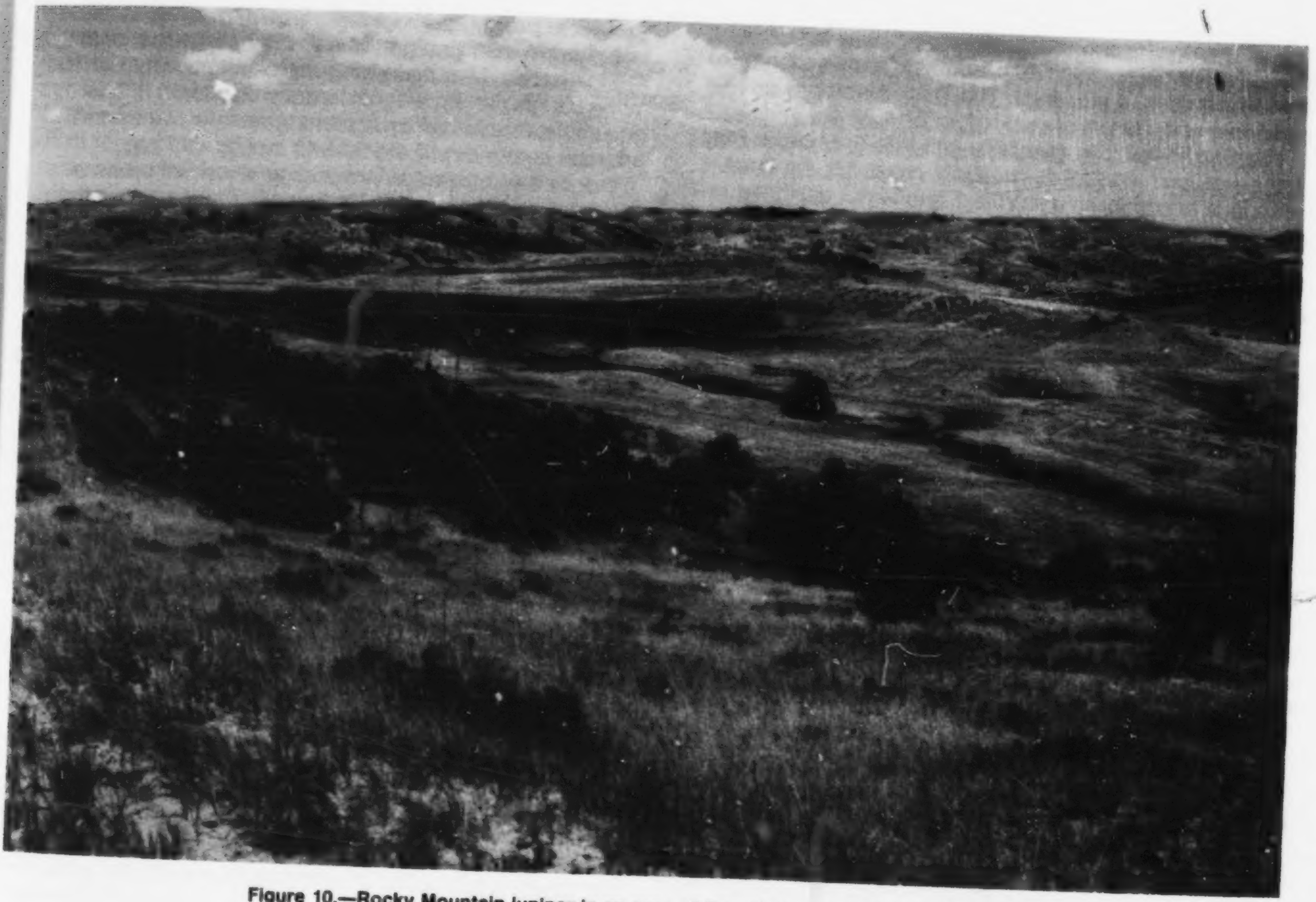

Figure 10.—Rocky Mountain juniper in an area of Samsil clay, 6 to 25 percent slopes.

SbE—Samsil-Rock outcrop complex, 15 to 40 percent slopes. This map unit occurs as areas of a moderately steep and steep, shallow, well drained Samsil soil intermingled with areas where shale crops out. The unit is on the breaks along the Cheyenne and Belle Fourche Rivers. The Samsil soil is on side slopes. The Rock outcrop is on convex slopes. Landslides are common on the steeper slopes. Areas are irregular in shape and 40 to more than 300 acres in size. They are 45 to 55 percent Samsil soil and 40 to 45 percent Rock outcrop. The Samsil soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Samsil soil is grayish brown clay about 2 inches thick. The next 5 inches also is grayish brown clay. The underlying material is grayish brown shaly clay. Light brownish gray shale is at a depth of about 13 inches. The soil is calcareous throughout.

The Rock outcrop is soft, clayey shale. It supports little or no vegetation.

Included with the Samsil soil and Rock outcrop in mapping are small areas of Kyle, Pierre, and Lohmiller soils. These soils make up less than 10 percent of any one mapped area. The deep Kyle and moderately deep Pierre soils are on the less steep parts of the landscape. The stratified, silty Lohmiller soils are on narrow flood plains.

Fertility and the content of organic matter are low in the Samsil soil. Available water capacity is very low. Permeability is slow. Runoff is rapid. The shrink-swell potential is very high.

The Rock outcrop does not support grazable vegetation. In all areas the Samsil soil supports native grasses that are used for grazing. Water erosion is a hazard. In places gullies form along cattle trails. Reestablishing vegetation is difficult.

This map unit is too steep and too shallow for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Rock outcrop is an additional limitation.

The Samsil soil is in capability unit VIIe-5, Shallow Clay range site, and windbreak suitability group 10; the Rock outcrop is in capability unit VIIIs-1 and is not assigned to a range site or a windbreak suitability group.

SdA—Satanta loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and 30 to 350 acres in size.

Typically, the surface layer is grayish brown loam about 1 inch thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 15 inches thick. It is brown and light olive brown, friable clay loam in the upper part and grayish brown, calcareous loam in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam. It has accumulations of carbonate throughout.

Included with this soil in mapping are small areas of Gerdrum and Nunn soils. These soils make up less than 10 percent of any one mapped area. Gerdrum soils have a sodium affected subsoil. They are along shallow drainageways. Nunn soils contain more clay in the subsoil than the Satanta soil. They are in positions on the landscape similar to those of the Satanta soil.

Fertility is medium and the content of organic matter moderate in the Satanta soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, and intermediate wheatgrass are suitable pasture plants. Alfalfa, winter wheat, oats, and grain sorghum are the main crops. Measures that conserve moisture are the main management needs. Examples are leaving crop residue on the surface and minimizing tillage.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIc-1; Silty range site; windbreak suitability group 3.

SdB—Satanta loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and 20 to 700 acres in size.

Typically, the surface layer is grayish brown loam about 1 inch thick. The subsurface layer is brown loam about 5 inches thick. The subsoil is about 15 inches thick. It is brown and light olive brown, friable clay loam in the upper part and grayish brown, calcareous loam in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay loam. It has accumulations of carbonate throughout. In places soft bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Gerdrum and Nunn soils. These soils make up less than 10 percent of any one mapped area. Gerdrum soils have a sodium affected subsoil. They are along shallow drainageways. Nunn soils contain more clay in the subsoil than the Satanta soil. They are in positions on the landscape similar to those of the Satanta soil.

Fertility is medium and the content of organic matter moderate in the Satanta soil. Tilth is good. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

Most of the acreage is cropland. This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, crested wheatgrass, and intermediate wheatgrass are suitable pasture plants. Alfalfa, winter wheat, oats, and grain sorghum are the main crops. Measures that conserve moisture and control erosion are the main management needs. Examples are leaving crop residue on the surface and minimizing tillage. Contour farming, grassed waterways, and terraces also help to control erosion.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

The capability unit is IIIe-1; Silty range site; windbreak suitability group 3.

St—Stetter clay. This deep, well drained, nearly level soil is on flood plains. It is frequently flooded. Areas are long and narrow and are 20 to 200 acres in size.

Typically, the surface layer is grayish brown clay about 3 inches thick. The underlying material to a depth of 60 inches is grayish brown and gray, stratified clay.

Included with this soil in mapping are small areas of Kyle and Swanboy soils. These soils make up less than 10 percent of any one mapped area. They are on foot slopes adjacent to the uplands. They are not stratified. Also, Swanboy soils contain more salts throughout than the Stetter soil.

Fertility and the content of organic matter are low in the Stetter soil. Tilth is poor. Available water capacity is low or moderate. Permeability is slow or very slow. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing or hay. Compaction is a problem.

Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. Although the soil is frequently flooded, the additional moisture is beneficial.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa and crested wheatgrass are examples of suitable pasture plants. Alfalfa and oats are the main crops. Measures that conserve moisture during dry periods and improve tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface and minimizing tillage. Chiseling and subsoiling improve tilth. Floodwater delays planting in some years, but in most years the additional moisture is beneficial and the flood damage minor.

This soil is suited to windbreaks and environmental plantings, but the clayey underlying material restricts root penetration. Windbreaks can be established, but optimum growth and survival are unlikely.

The capability unit is IVs-3; Clayey Overflow range site; windbreak suitability group 4C.

SwA—Swanboy clay. This deep, well drained, nearly level soil is on foot slopes along drainageways. Areas are irregular in shape and 10 to 300 acres in size.

Typically, the surface layer is light brownish gray clay about 2 inches thick. The subsoil is light brownish gray and olive gray, firm clay about 20 inches thick. It has gypsum and salt crystals in the lower part. The underlying material to a depth of 60 inches is olive gray clay. It has gypsum and salt crystals throughout.

Included with this soil in mapping are small areas of Kyle and Stetter soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Kyle soils do not have visible salts within a depth of 15 inches. They are on uplands, generally near the edges of the mapped areas. Slickspots are in scattered areas throughout the map unit. They do not support grazable vegetation. The stratified Stetter soils are on flood plains.

Fertility and the content of organic matter are low in the Swanboy soil. Tilth is very poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil generally is not suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the very poor tilth and the high content of salts in the subsoil.

The capability unit is VIs-6; Dense Clay range site; windbreak suitability group 10.

SyA—Swanboy-Slickspots complex, 0 to 2 percent slopes. This map unit occurs as areas of a deep, well drained, nearly level Swanboy soil intermingled with Slickspots. It is on foot slopes along drainageways. The Swanboy soil is on slight rises. The Slickspots are in slightly depressed areas. Areas are irregular in shape and 20 to 100 acres in size. They are 50 to 60 percent Swanboy soil and 30 to 35 percent Slickspots. The Swanboy soil and Slickspots occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Swanboy soil is light brownish gray clay about 2 inches thick. The subsoil is light brownish gray and olive gray, firm clay about 20 inches thick. It has gypsum and salt crystals in the lower part. The underlying material to a depth of 60 inches is olive gray clay. It has gypsum and salt crystals throughout.

The Slickspots occur as slightly depressed, barren areas that have a puddled or slick surface. Visible accumulations of salts are at or near the surface. The soil material to a depth of about 60 inches is massive clay.

Included with the Swanboy soil and the Slickspots in mapping are small areas of Kyle, Pierre, and Stetter soils. These included soils make up less than 15 percent of any one mapped area. Kyle and Pierre soils are not so dense as the Swanboy soil. Also, they have a lower content of salts. They are on the high parts of the landscape. Stetter soils are stratified. They are on narrow flood plains.

Fertility and the content of organic matter are low in the Swanboy soil. Tilth is very poor. Available water capacity is low or moderate. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

All of the acreage supports native grasses and is used for grazing. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth. The Slickspots generally support little or no vegetation, but they do support a sparse stand of weeds and pricklypear during wet periods.

This map unit generally is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The very poor tilth and the salts are limitations.

The Swanboy soil is in capability unit VIs-6, Dense Clay range site, and windbreak suitability group 10; the Slickspots are in capability unit VIIIs-3 and are not assigned to a range site or a windbreak suitability group.

TdB—Tanna-Delridge complex, 2 to 6 percent slopes. These moderately deep, well drained, gently sloping soils are on uplands. The Tanna soil is on the lower side slopes. The Delridge soil is on ridges. Areas are irregular in shape and 10 to 100 acres in size. They are 50 to 60 percent Tanna soil and 20 to 30 percent Delridge soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Tanna soil is grayish brown silty clay loam about 5 inches thick. The subsoil is about 22 inches thick. It is dark grayish brown, grayish brown, and light brownish gray silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous silty clay loam. It has accumulations of carbonate throughout. Light brownish gray, soft shale is at a depth of about 32 inches.

Typically, the surface layer of the Delridge soil is grayish brown loam about 3 inches thick. The next 6 inches is brown loam. The underlying material is light brownish gray silt loam and loam. Light gray siltstone is at a depth of about 24 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Abor, Eapa, Grail, and Yawdim soils. These included soils make up less than 20 percent of any one mapped area. Abor and Eapa soils are in positions on the landscape similar to those of the Tanna soil. The clayey Abor soils are calcareous throughout. The loamy Eapa soils are more than 40 inches deep to bedrock. Grail soils are dark to a depth of more than 16 inches. They are in swales. The silty Yawdim soils are less than 20 inches deep to shale. They are on ridges.

Fertility is medium in the Tanna soil and low in the Delridge soil. The content of organic matter is moderate in the Tanna soil and low in the Delridge soil. Tilth is fair in the Tanna soil and good in the Delridge soil. Available water capacity is moderate in the Tanna soil and low in the Delridge soil. Permeability is slow in the Tanna soil and moderate in the Delridge soil. Runoff is medium on both soils. The shrink-swell potential is high in the Tanna soil and moderate in the Delridge soil.

About half of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay, but the high content of lime in the Delridge soil adversely affects the availability of plant nutrients. Crested wheatgrass, intermediate wheatgrass, and alfalfa are examples of suitable pasture plants. Alfalfa, winter wheat, oats, and grain sorghum are the main crops. Measures that control erosion, conserve moisture, and improve tilth and fertility are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage. Contour farming, grassed waterways, and terraces also help to control erosion. Chiseling or subsoiling increases the rate of water intake and improves tilth.

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings, but the low available water capacity and high content of lime in the Delridge soil are limitations. Windbreaks can be established on the Delridge soil, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The Tanna soil is in capability unit IIIe-1, Clayey range site, and windbreak suitability group 4L; the Delridge soil is in capability unit IVe-3, Thin Upland range site, and windbreak suitability group 8.

TdC—Tanna-Delridge complex, 6 to 9 percent slopes. These moderately deep, well drained, moderately sloping soils are on uplands. Areas are irregular in shape and 10 to 200 acres in size. They are 40 to 50 percent Tanna soil and 30 to 40 percent Delridge soil. The Tanna soil is on side slopes. The Delridge soil is on ridges. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Tanna soil is grayish brown silty clay loam about 5 inches thick. The subsoil is about 22 inches thick. It is dark grayish brown, grayish brown, and light brownish gray silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous silty clay loam. It has accumulations of carbonate throughout. Light brownish gray, soft shale is at a depth of about 32 inches.

Typically, the surface layer of the Delridge soil is grayish brown loam about 3 inches thick. The next 6 inches is brown loam. The underlying material is grayish brown and light brownish gray loam and silt loam. Light gray siltstone is at a depth of about 24 inches. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Abor, Eapa, Grail, and Yawdim soils. These included soils make up less than 20 percent of any one mapped area. The clayey Abor soils are calcareous throughout. The loamy Eapa soils are more than 40 inches deep to bedrock. Grail soils are dark to a depth of more than 16 inches. They are in swales. The silty Yawdim soils are less than 20 inches deep to shale. They are on ridges.

Fertility is medium in the Tanna soil and low in the Delridge soil. The content of organic matter is moderate in the Tanna soil and low in the Delridge soil. Tilth is fair in the Tanna soil and good in the Delridge soil. Available water capacity is moderate in the Tanna soil and low in the Delridge soil. Permeability is slow in the Tanna soil and moderate in the Delridge soil. Runoff is medium in both soils. The shrink-swell potential is high in the Tanna soil and moderate in the Delridge soil.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range. Water erosion is a hazard, however, if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils are suited to cultivated crops and to tame pasture and hay, but the high content of lime in the

Delridge soil adversely affects the availability of plant nutrients. Intermediate wheatgrass and alfalfa are examples of suitable pasture plants. Winter wheat, oats, and grain sorghum are the main crops. Measures that control erosion and improve fertility and tilth are the main management needs in cultivated areas. Examples are leaving crop residue on the surface, including grasses and legumes in the cropping system, and minimizing tillage. Chiseling or subsoiling increases the rate of water intake and improves tilth. Contour farming, grassed waterways, and terraces help to control erosion.

These soils are suited to windbreaks and environmental plantings, but the low available water capacity and high content of lime in the Delridge soil are limitations. Windbreaks can be established on the Delridge soil, but optimum growth is unlikely. Planting on the contour helps to control erosion.

The capability unit is IVe-1. The Tanna soil is in Clayey range site, windbreak suitability group 4L; the Delridge soil in Thin Upland range site, windbreak suitability group 8.

TsB—Tanna-Savo complex, 2 to 6 percent slopes. These well drained, gently sloping soils are on uplands. The moderately deep Tanna soil is on ridges. The deep Savo soil is on the lower side slopes and in swales. Slopes generally are long and smooth. Areas are irregular in shape and 15 to 300 acres in size. They are 50 to 60 percent Tanna soil and 20 to 30 percent Savo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Tanna soil is grayish brown silty clay loam about 5 inches thick. The subsoil is about 22 inches thick. It is dark grayish brown, grayish brown, and light brownish gray silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous silty clay loam. It has accumulations of carbonate throughout. Light brownish gray, soft shale is at a depth of about 32 inches.

Typically, the surface layer of the Savo soil is grayish brown silt loam about 4 inches thick. The subsoil is about 26 inches thick. It is grayish brown and light brownish gray, firm silty clay and friable silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay loam.

Included with these soils in mapping are small areas of Cabbart, Delridge, and Grail soils. These included soils make up less than 20 percent of any one mapped area. The shallow Cabbart soils and the calcareous Delridge soils are on the upper side slopes and ridges. Grail soils are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium and the content of organic matter moderate in the Tanna and Savo soils. Tilth is fair in the Tanna soil and good in the Savo soil. Available water capacity is moderate in the Tanna soil and high in the Savo soil. Permeability is slow in the Tanna soil and moderately slow in the Savo soil. Runoff is medium on both soils. The shrink-swell potential is high.

About half of the acreage is cropland. These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, oats, winter wheat, and grain sorghum are the main crops. Intermediate wheatgrass and alfalfa are examples of suitable pasture plants. Measures that control erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling increases the rate of water intake and improves tilth.

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IIIe-1. The Tanna soil is in Clayey range site, windbreak suitability group 4L; the Savo soil is in Silty range site, windbreak suitability group 3.

TsC—Tanna-Savo complex, 6 to 9 percent slopes. These well drained, moderately sloping soils are on uplands. The moderately deep Tanna soil is on ridges. The deep Savo soil is on the lower side slopes and in swales. Slopes generally are long and smooth. Areas are irregular in shape and 10 to 400 acres in size. They are 50 to 60 percent Tanna soil and 20 to 30 percent Savo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Tanna soil is grayish brown silty clay loam about 5 inches thick. The subsoil is about 22 inches thick. It is dark grayish brown, grayish brown, and light brownish gray silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous silty clay loam. It has accumulations of carbonate throughout. Light brownish gray, soft shale is at a depth of about 32 inches.

Typically, the surface layer of the Savo soil is grayish brown silt loam about 4 inches thick. The subsoil is about 26 inches thick. It is grayish brown and light brownish gray, firm silty clay and friable silty clay loam. It is calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray, calcareous silty clay loam.

Included with these soils in mapping are small areas of Cabbart, Delridge, and Grail soils. These included soils make up less than 20 percent of any one mapped area. The shallow Cabbart soils and the calcareous Delridge soils are on the upper side slopes and ridges. Grail soils are dark to a depth of more than 16 inches. They are in swales.

Fertility is medium and the content of organic matter moderate in the Tanna and Savo soils. Tilth is fair in the Tanna soil and good in the Savo soil. Available water capacity is moderate in the Tanna soil and high in the Savo soil. Permeability is slow in the Tanna soil and moderately slow in the Savo soil. Runoff is medium on both soils. The shrink-swell potential is high.

These soils are suited to cultivated crops and to tame pasture and hay. Alfalfa, winter wheat, oats, and grain sorghum are the main crops. Measures that control erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Contour farming, terraces, and grassed waterways also help to control erosion.

Generally, no major hazards or limitations affect the use of these soils for range. Water erosion is a hazard, however, if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The capability unit is IVe-1. The Tanna soil is in Clayey range site, windbreak suitability group 4L; the Savo soil is in Silty range site, windbreak suitability group 3.

TwC—Twilight-Marmarth-Parchin fine sandy loams, 4 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are on uplands. The Twilight soil is on the steeper side slopes. The Marmarth and Parchin soils are in the less sloping areas, generally above the Twilight soil. Areas are irregular in shape and 20 to 1,600 acres in size. They are about 35 to 45 percent Twilight soil, 30 to 40 percent Marmarth soil, and 20 to 30 percent Parchin soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Twilight soil is dark grayish brown fine sandy loam about 3 inches thick. The subsoil is brown fine sandy loam about 15 inches thick. It is calcareous in the lower part. The underlying material is light gray, calcareous fine sandy loam. Light gray sandstone is at a depth of about 36 inches.

Typically, the surface layer of the Marmarth soil is brown fine sandy loam about 4 inches thick. The subsoil is brown and grayish brown clay loam about 16 inches thick. It is calcareous in the lower part. The underlying material is light brownish gray, calcareous loam. Light gray, soft sandstone is at a depth of about 28 inches. In some areas the bedrock is below a depth of 40 inches.

Typically, the surface layer of the Parchin soil is brown fine sandy loam about 6 inches thick. The subsurface layer is pale brown fine sandy loam about 6 inches thick. The subsoil is brown, friable sandy clay loam about 20 inches thick. In the lower part it is calcareous and has gypsum and other salts. Light brownish gray, calcareous, soft sandstone is at a depth of about 32 inches. In some areas the surface soil is less than 6 inches thick. In places the subsoil contains more clay.

Included with these soils in mapping are small areas of Blackhall soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Blackhall soils are 10 to 20 inches deep to bedrock. They are on ridges. Slickspots have a dispersed surface and have a high content of salts throughout. They are in small pits and depressions.

Fertility is low in the Twilight and Parchin soils and medium in the Marmarth soil. The content of organic matter is low in the Twilight and Parchin soils and moderate in the Marmarth soil. Tilth is fair in the Twilight and Parchin soils and good in the Marmarth soil. Available water capacity is low in all three soils. Permeability is moderately rapid in the Twilight soil, moderate in the Marmarth soil, and slow or very slow in the Parchin soil. Runoff is medium on all three soils. The shrink-swell potential is low in the Twilight soil and moderate in the Marmarth and Parchin soils.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of these soils for range; however, wind erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils are suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass and alfalfa are examples of suitable pasture plants. Alfalfa, winter wheat, oats, and grain sorghum are the main crops. Measures that control wind erosion, conserve moisture, and improve tilth are the main management needs. Examples are leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system. Chiseling or subsoiling increases the rate of water intake and improves tilth in the Parchin soil. Stripcropping helps to control wind erosion (fig. 11).

These soils are suited to windbreaks and environmental plantings, but they are droughty. Trees and shrubs can be established, but optimum growth is unlikely.

The Twilight soil is in capability unit IVe-7, Sandy range site, and windbreak suitability group 6R; the Marmarth soil is in capability unit IVe-1, Silty range site, and windbreak suitability group 6R; the Parchin soil is in

Figure 11.—Stripcropping in an area of Twilight-Marmarth-Parchin fine sandy loams, 4 to 9 percent slopes.

capability unit IVe-12, Claypan range site, and windbreak suitability group 9.

WhC—Winler clay, 2 to 9 percent slopes. This moderately deep, well drained, gently sloping and moderately sloping soil is on uplands. Areas are irregular in shape and 20 to 300 acres in size.

Typically, the surface layer is grayish brown clay about 3 inches thick. The subsoil is olive and light olive gray, firm clay about 12 inches thick. It has gypsum and other salts in the lower part. The underlying material is light olive gray clay. It has gypsum and other salts throughout. Light olive gray shale is at a depth of about 23 inches. In places visible salts are within a depth of 8 inches.

Included with this soil in mapping are small areas of ismas and Swanboy soils. These soils make up less han 15 percent of any one mapped area. Lismas soils re 8 to 17 inches deep to shale. They generally are bove the Winler soil on the landscape. The deep Swanboy soils are on foot slopes, generally below the Winler soil.

Fertility and the content of organic matter are low in the Winler soil. Tilth is very poor. Available water capacity is very low. Permeability is very slow. Runoff is medium. The shrink-well potential is very high in the Winler soil.

Most of the acreage supports native grasses and is used for range. Compaction is a problem. Restricted grazing during wet periods helps to prevent surface compaction and deterioration of tilth.

This soil generally is not suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the very poor tilth, the droughtiness, and the high content of salts in the subsoil.

The capability unit is VIs-6; Dense Clay range site; windbreak suitability group 10.

WlC—Winler-Lismas clays, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on uplands. The moderately deep Winler soil generally is on the lower side slopes. The shallow Lismas soil is on the higher, more convex parts of the landscape. Areas are irregular in shape and 30 to 500 acres in size. They are 55 to 70 percent Winler soil and 25 to 40 percent Lismas soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Winler soil is grayish brown clay about 3 inches thick. The subsoil is olive and light olive gray, firm clay about 12 inches thick. The underlying material is light olive gray clay. Light olive gray shale is at a depth of about 23 inches. In places visible salts are within a depth of 8 inches.

Typically, the surface layer of the Lismas soil is light olive gray clay about 3 inches thick. The underlying material is light olive gray clay and shaly clay. Light olive gray shale is at a depth of about 11 inches.

Included with these soils in mapping are small areas of Rock outcrop and Swanboy soils. These inclusions make up less than 15 percent of any one mapped area. The Rock outcrop is on the steep sides of drainageways. The deep Swanboy soils are on foot slopes, generally below the Winler soil.

Fertility and the content of organic matter are low in the Winler and Lismas soils. Available water capacity is very low. Permeability is very slow. Runoff is rapid. The shrink-swell potential is very high.

Most of the acreage supports native grasses and is used for grazing. Erosion is a hazard in overgrazed areas. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

These soils generally are unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Very poor tilth, the shallow depth to shale, and the slope are limitations.

The Winler soil is in capability unit VIs-6, Dense Clay range site; the Lismas soil is in capability unit VIe-12, Shallow Dense Clay range site. Both soils are in windbreak suitability group 10.

YaC—Yawdim silty clay loam, 6 to 9 percent slopes. This shallow, well drained, moderately sloping soil is on uplands. Areas are irregular in shape and 10 to 250 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 2 inches thick. The underlying material is olive gray and gray silty clay. Light gray shale is at a depth of about 19 inches. The soil is calcareous throughout. In places the content of sand is higher throughout the profile.

Included with this soil in mapping are small areas of Abor and Lawther soils. These soils are 20 to 40 inches deep to bedrock. They are lower on the landscape than the Yawdim soil.

Fertility and the content of organic matter are low in the Yawdim soil. Available water capacity is very low. Permeability is slow. Runoff is medium. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for hay. Water erosion is a hazard if the range is overgrazed. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns help to prevent gullying.

This soil generally is not suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The shallow depth to shale is the main limitation.

The capability unit is VIe-12; Shallow range site; windbreak suitability group 10.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

John Deppe, district conservationist, Soil Conservation Service, helped write this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil. No prime farmland is recognized in the survey area.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 14 percent of the acreage in the survey area is used for tame pasture or hay or for cultivated crops. The acreage is about evenly divided between cultivated crops and tame pasture or hay. The major crops are winter wheat, oats, and grain sorghum. Barley, spring wheat, corn, and millet are also grown (*6*). Alfalfa is harvested mainly for hay, corn is harvested mainly for silage, and oats is grown as a cash crop and as livestock feed.

The potential of the soils in the survey area for increased crop production is good. About 110,000 acres of potentially good cropland is currently used as range and about 40,000 acres as tame pasture and hayland (*11*). In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe the management needed on the cropland in the county.

Water erosion reduces productivity and results in sedimentation. It is a hazard on Abor, Delridge, Eapa, Kyle, Nunn, Pierre, and other soils if the slope is more than about 2 percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Delridge soils. When erosion occurs, sediment rich in nutrients enters streams and lakes.

Measures that control erosion minimize the pollution of streams and lakes by sediment and help to preserve water quality for fish, wildlife, recreation, and municipal use. They also reduce the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that will not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions reduce the length of slopes and the runoff rate and thus help to control erosion. They are most practical on deep, well drained soils that have long, smooth slopes, such as Eapa, Nunn, and Assinniboine soils. In many areas, however, the soils are poorly suited to terraces and diversions because of short, irregular slopes. In some soils, such as Tanna, Abor, Pierre, Twilight, Marmarth, and Attewan soils, an unfavorable subsoil would be exposed in terrace channels. Grassed waterways are effective in controlling gully erosion.

Wind erosion is a slight to moderate hazard on many of the soils in the survey area. The hazard is especially severe on Assinniboine, Delridge, Glenberg, Marmarth, Parchin, and Twilight soils. Wind erosion can damage these soils in a few hours if winds are strong and the soils are dry and not protected by a plant cover or surface mulch. An adequate plant cover, a cover of crop residue, stripcropping, and a rough surface help to control wind erosion. Windbreaks of suitable trees and shrubs also are effective in controlling wind erosion.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in the local office of the Soil Conservation Service.

Soil fertility helps to determine the yields that can be obtained. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. In soils that have a high content of lime in the surface layer, such as Delridge soils, the kinds and amounts of fertilizer needed generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crops, and on the expected yield level. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous. If tilled when wet, Kyle and Pierre soils tend to be very hard and cloddy when dry. As a result of the cloddiness, preparing a good seedbed is difficult. These soils dry out slowly in the spring and cannot be easily tilled when dry. Tilth is poor in Gerdrum, Loburn, and other soils that have a claypan subsoil. Timely tillage, inclusion of grasses and legumes in the cropping system, and incorporation of crop residue into the soil improve tilth and increase the rate of water intake.

Field crops suited to the soils and climate of the survey area include small grain and row crops. Winter wheat and oats are the main small grain crops. Barley and spring wheat are grown on a lesser acreage. The main row crop is grain sorghum; however, corn also is grown on a small acreage. About half of the acreage of corn is harvested for silage.

Winter wheat is planted on summer fallowed land. The best suited soils for field crops are more than 40 inches deep to bedrock. Because of their landscape position, they receive additional moisture as runoff from the surrounding uplands. Soils that have a claypan subsoil, such as Gerdrum, Loburn, and Parchin soils, are better suited to early maturing small grain than to other crops. These soils tend to be droughty late in the growing season because the claypan subsoil restricts root penetration and the rate of water intake.

Pasture plants best suited to the climate and to most of the soils in the survey area include alfalfa, crested wheatgrass, and intermediate wheatgrass. Crested wheatgrass is well suited to soils that tend to be droughty, but it should not be planted in areas where the slope is more than 6 percent because erosion is a hazard. Pubescent wheatgrass also is suited to soils that tend to be droughty.

If the pasture is overgrazed, the desirable grasses lose vigor and die and usually are replaced by annual grasses and by weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition. Restricted grazing during wet periods helps to prevent compaction in soils that have a clayey surface layer or a claypan subsoil.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*9*). These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 or IIIe-4.

The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and in "Interpretive Groups."

Rangeland

Rod Baumberger, range conservationist, and John Deppe, district conservationist, Soil Conservation Service, helped prepare this section.

Rangeland supports native vegetation suitable for grazing or browsing. It includes land revegetated to native plants. This vegetation consists mainly of grasses and grasslike plants, forbs, or shrubs. The amounts and kinds of native vegetation grown in any one area are determined by the soil, topography, climate, past use, and management.

All of the survey area was rangeland before the first permanent settlers arrived. Currently, about 86 percent of the survey area supports native vegetation. Rangeland supplies a major portion of the forage for the livestock in the area.

Approximately 90 percent of the farm and ranch income in the survey area is derived from the sale of livestock. Most of the ranches are cow-calf operations. Some are sheep and yearling operations, and some ranchers raise all three. This practice permits greater flexibility in adjusting livestock numbers during periods of drought. The rangeland generally is grazed throughout the year. The forage provided by rangeland is supplemented by protein concentrates and hay in winter. It also is supplemented by pastures of tame grasses, such as crested wheatgrass and intermediate wheatgrass.

The survey area is part of the mixed grass prairie. The native vegetation is dominated by mid and short grasses and forbs, but some tall grasses are also mixed in with these plants. This mixed grass prairie is made up of cool- and warm-season plants, which provide good quality forage throughout the growing season. The cool-season plants grow mostly during April, May, and June and the warm-season plants during June, July, and August. The cool-season grasses may start growing again in September and October if fall rains are adequate.

The native vegetation in some parts of the survey area is producing below its potential because of past misuse. The tall grasses and some of the mid grasses have been replaced by short grasses. The result is a total reduction of available forage. In most areas, however, enough of the original plants remain for good grazing management to reestablish high quality plants.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce native vegetation. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important. Soils that produce approximately the same kinds, amounts, and proportions of native vegetation make up a range site. The potential native vegetation on a range site is the stabilized plant community that the site is capable of producing. It consists of the plants that were growing when the region was settled. This plant community maintains itself and changes very little as long as the environment remains unchanged. The relationship between soils and vegetation was ascertained during this survey; thus range sites generally can be determined directly from the soil map.

The plants within the native plant community are sometimes grouped or classed as decreasers, increasers, or invaders, depending on their response to grazing pressure. *Decreasers* are plants that respond to overgrazing by decreasing in production. They generally are the most productive plants and the ones most preferred by the grazing animals. *Increasers* are plants that respond to grazing pressure, at least initially, by increasing in amount as the more desirable decreaser plants become less productive. Increasers generally are less productive and less preferred by grazing animals. *Invaders* are plants that are not part of the original plant community but invade the plant community because of some kind of disturbance or continued overgrazing. Some invader plants have little value for grazing. Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others. A cool-season plant, for example, may be a decreaser if the range site is grazed only during the spring but would be an increaser if the same site were grazed only during the summer. The reverse would be true for the more preferred warm-season plants. Restricting grazing to the spring would cause the warm-season plants to increase in abundance, and restricting grazing to the summer would cause the warm-season plants to decrease.

Table 6 shows, for each soil, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. *Potential annual production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management maintains the capacity of the rangeland to produce forage for livestock and game animals and to provide wildlife habitat, water, and watershed protection. The primary objective of good range management is to keep the rangeland in excellent or good condition. The main management concern is responding to important changes in the plant community of a range site.

Range condition is determined by comparing the present vegetation on a range site with the potential native plant community for the site. Four range condition classes are recognized. The range site is in excellent condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less. The potential production of rangeland depends on the range site, the range condition, and the moisture available to plants during the growing season.

Range management that maintains or improves the range condition is needed on all rangeland in the survey area. It includes proper stocking rates and rotation grazing or deferred grazing programs, which allow for the proper sequence of grazing and provide rest periods that maintain or improve the vigor of the key plants. Good range management also includes range seeding, fencing, and measures that provide water for livestock. Contour furrowing, pitting, deep chiseling, and other kinds of mechanical treatment are needed on some range sites.

There are 16 range sites in the survey area. They are Clayey, Clayey Overflow, Claypan, Closed Depression, Dense Clay, Loamy Overflow, Loamy Terrace, Saline Lowland, Sands, Sandy, Shallow, Shallow Clay, Shallow Dense Clay, Silty, Thin Claypan, and Thin Upland. At the end of each map unit description, the soils are assigned to an appropriate range site. The paragraphs that follow describe the range sites in the survey area.

Clayey range site. The potential native vegetation on this site is mid and short prairie grasses interspersed with a variety of forbs and shrubs. Green needlegrass and western wheatgrass, which are cool-season grasses, make up about 65 percent of the vegetation. Warm-season grasses make up about 25 percent, as follows: blue grama, 15 percent, and buffalograss, 10 percent. Forbs, such as American vetch, scurfpea, yarrow, and sagewort, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. Green needlegrass and western wheatgrass rapidly decrease in amount after continued overgrazing because the livestock prefer these plants. If overgrazing continues, the stand of western wheatgrass and green needlegrass is replaced by buffalograss and blue grama. The amount of the most productive grasses can be increased or maintained by proper stocking rates. Other management practices include rotation grazing, deferred grazing, and a combination of contour furrowing, pitting, and deferred grazing.

Clayey Overflow range site. The potential native vegetation on this range site is an excellent stand of mid and tall grasses. Cool-season grasses make up about 90 percent of the vegetation. Western wheatgrass is the major cool-season grass. Green needlegrass is of lesser extent. Warm-season grasses, such as buffalograss and blue grama, are in the understory. Forbs and woody species are not of major importance when this site is in excellent condition.

The major management concern on this site is maintaining the amount of the most productive grasses. After overgrazing, the amount of western wheatgrass decreases and the amount of buffalograss, blue grama, and weeds increases. Japanese brome and cocklebur are common invaders. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Western wheatgrass, the dominant cool-season grass, makes up about 40 percent of the vegetation. Needleandthread, green needlegrass, and prairie sandreed make up 25 percent. Warm-season grasses, such as blue grama and buffalograss, also make up 25 percent. Forbs, such as sagewort, broom snakeweed, and American vetch, and shrubs, such as sagebrush, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overgrazing, the amount of western wheatgrass, green needlegrass, and prairie sandreed decreases while the amount of short grasses, such as blue grama and buffalograss, and forbs increases. Low forage production is the result. If overgrazing continues, a considerable amount of the site is bare, especially during dry cycles. Weeds are common during wet cycles. The amount of the most productive grasses can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Closed Depression range site. The potential native vegetation on this site is mid grasses. Western wheatgrass makes up about 90 percent of the vegetation. Sedges, rushes, and inland saltgrass make up the remainder. On the wetter sites, the amount of western wheatgrass is lower and the amount of rushes, sedges, and inland saltgrass is higher.

The main management concern on this site is maintaining the amount of western wheatgrass. After continued overgrazing, this grass is replaced by rushes and weeds. The amount of western wheatgrass can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Dense Clay range site. The potential native vegetation on this site is mid prairie grasses interspersed with forbs. Cool-season grasses are western wheatgrass, which makes up 60 percent of the vegetation, and green needlegrass, which makes up about 30 percent. Forbs, such as wild onion and American vetch, make up about 10 percent. Short grasses, such as buffalograss and blue grama, do not grow on this site.

The major management concern on this site is maintaining the amount of green needlegrass and western wheatgrass. After continuous overgrazing, these grasses are replaced by unpalatable plants or the surface becomes bare. The formation of bare areas reduces productivity and increases the susceptibility to erosion. The amount of green needlegrass and western wheatgrass can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Loamy Overflow range site. The potential native vegetation on this site is an excellent stand of tall and mid grasses. Big bluestem makes up about 40 percent of the vegetation. Other grasses are as follows: switchgrass, 5 percent; green needlegrass, 10 percent; little bluestem, 15 percent; and western wheatgrass, 20 percent. Short grasses and sedges are in smaller amounts. Shrubs, such as leadplant and rose, generally are throughout the site. Scattered stands of green ash, American elm, chokecherry, buffaloberry, and willow are adjacent to some streams.

The major management concern on this site is maintaining the amount of the most productive grasses. After overgrazing, big bluestem, western wheatgrass, little bluestem, green needlegrass, and other mid grasses are replaced by blue grama, buffalograss, and weeds. Japanese brome and foxtail barley are common invaders. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Loamy Terrace range site. The potential native vegetation on this site is a mixture of mid and tall, cool-season grasses. Western wheatgrass and green needlegrass make up about 70 percent of the vegetation. Needleandthread and prairie sandreed make up about 20 percent. The remainder consists of blue grama, buffalograss, sedges, sagewort, roses, and big and silver sagebrush.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overgrazing, the amount of western wheatgrass, green needlegrass, needleandthread, and prairie sandreed decreases while the amount of buffalograss, blue grama, forbs, and woody plants increases. The amount of the most productive grasses can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Saline Lowland range site. The potential native vegetation on this range site is salt tolerant plants. Western wheatgrass makes up about 60 percent of the vegetation. Prairie cordgrass, inland saltgrass, blue grama, and alkali sacaton make up about 30 percent. Sedges and forbs make up the remainder. In some areas prairie cordgrass makes up as much as 60 percent of the vegetation.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overgrazing, the amount of western wheatgrass, prairie cordgrass, and alkali sacaton decreases and inland saltgrass soon becomes the principal grass on the site. The amount of the most productive grasses can be maintained by proper stocking rates and by rotation grazing or deferred grazing.

Sands range site. The potential native vegetation on this site is mainly warm-season, tall and mid grasses. These grasses make up about 80 percent of the vegetation, as follows: little bluestem, 30 percent; sand bluestem, 20 percent; prairie sandreed, 20 percent; sand dropseed, 5 percent; and an understory of blue grama and sedges, 5 percent. Cool-season grasses, such as needleandthread and western wheatgrass, make up about 10 percent of the vegetation. Forbs and woody plants, such as leadplant, rose, and sand cherry, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overuse, the bluestems are replaced by sand dropseed and blue grama. If overuse continues, green sagewort and sandbur increase in amount or invade. In places, the surface is bare and blowouts can become a severe hazard. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Sandy range site. The potential native vegetation on this site is mixed prairie grasses, chiefly mid and tall grasses. Warm-season grasses, such as little bluestem, sand bluestem, big bluestem, blue grama, and prairie sandreed, make up about 40 percent of the vegetation. Cool-season grasses, such as needleandthread and western wheatgrass, make up about 30 percent. The remainder consists of forbs, such as scurfpea and sagewort.

The major management concern on this site is maintaining the amount of the most productive grasses. After continuous overgrazing, the bluestems and prairie sandreed are replaced by needleandthread and western wheatgrass. If overgrazing continues, these grasses are replaced by sand dropseed, threadleaf sedge, and blue grama and by sagewort, a common weedy increaser. Low forage production is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Shallow range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses make up about 75 percent of the vegetation, as follows: little bluestem, 50 percent; sideoats grama, 10 percent; big bluestem, 5 percent; blue grama, 5 percent; and prairie sandreed, 5 percent. Cool-season grasses, such as needleandthread and western wheatgrass, make up about 10 percent. Other plants, such as sedges, forbs, and shrubs, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overgrazing, the amount of little bluestem and big bluestem decreases and the amount of needleandthread and sideoats grama increases. If overgrazing continues, sideoats grama and needleandthread are replaced by a sparse cover of sedges, blue grama, and weeds. The amount of the most productive grasses can be maintained or increased by proper stocking rates and by rotation grazing or timely deferment of grazing.

Shallow Clay range site. The potential native vegetation on this site is mixed prairie grasses. Cool-season grasses, such as western wheatgrass and green needlegrass, make up about 45 percent of the vegetation. Warm-season grasses, such as sideoats grama, little bluestem, and blue grama, also make up about 45 percent. Forbs, such as scurfpea, sagewort, and blacksamson, make up about 5 percent. Shrubs, such as skunkbush sumac, make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. Green needlegrass and little bluestem decrease in amount after overgrazing because the livestock prefer these plants. If overgrazing continues, the amount of western wheatgrass and sideoats grama decreases while the amount of blue grama and unpalatable forbs increases. The amount of the most productive plants can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Shallow Dense Clay range site. The potential native vegetation on this site is mid prairie grasses interspersed with forbs. Cool-season grasses are western wheatgrass, which makes up about 60 percent of the vegetation, and green needlegrass, which makes up about 20 percent. Sideoats grama makes up about 5 percent. Forbs, such as wild onion, American vetch, and wild parsley, make up the remainder. Short grasses, such as blue grama and buffalograss, do not grow on this site.

The major management concern on this site is maintaining the amount of western wheatgrass and green needlegrass. After continued overgrazing, these grasses are replaced by unpalatable plants or the surface becomes bare. The bare surface is highly susceptible to erosion. The amount of green needlegrass and western wheatgrass can be maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Silty range site. The potential native vegetation on this site is cool-season grasses, which make up about 65 percent of the vegetation. Green needlegrass and western wheatgrass are the major cool-season grasses. Needleandthread is of lesser extent. Warm-season grasses, such as little bluestem, prairie sandreed, buffalograss, and blue grama, make up about 25 percent of the vegetation. Forbs, such as sagewort, heath aster, yarrow, and Missouri goldenrod, and shrubs make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. After continued overuse, western wheatgrass, green needlegrass, and needleandthread are replaced by buffalograss and blue grama. Low productivity is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Thin Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Short, warm-season grasses dominate the site. Blue grama makes up about 40 percent of the vegetation, and buffalograss makes up about 15 percent. Mid, cool-season grasses, such as western wheatgrass and needleandthread, make up about 30 percent. Forbs, such as sagewort and broom snakeweed, and shrubs, such as pricklypear and sagebrush, make up the remainder. On sites that are somewhat saline, inland saltgrass may make up about 10 percent of the vegetation and as much as 20 percent of the surface is bare.

The major management concern on this site is maintaining the amount of western wheatgrass and needleandthread. After continued overgrazing, these grasses are replaced by blue grama, buffalograss, and inland saltgrass. If overgrazing continues, a considerable amount of the site is bare, especially during dry cycles. Weeds are common during wet cycles. The amount of the desired grasses can be maintained or increased by proper stocking rates and by timely deferment of grazing or rotation grazing.

Thin Upland range site. The potential native vegetation on this site is mixed prairie grasses. Blue grama and threadleaf sedge make up about 30 percent of the vegetation. Western wheatgrass, prairie sandreed, sideoats grama, and little bluestem also make up about 30 percent. Forbs, such as sagewort, and woody plants make up the remainder.

The major management concern on this site is maintaining the amount of the most productive grasses. The amount of mid grasses, such as needleandthread, western wheatgrass, and little bluestem, decreases after overgrazing. If overgrazing continues, sedges and blue grama dominate the site. Low productivity is the result. The amount of the most productive grasses can be increased or maintained by proper stocking rates and by timely deferment of grazing or rotation grazing.

Native Woods, Windbreaks, and Environmental Plantings

Sheridan I. Dronen, forester, Soil Conservation Service, helped prepare this section.

In this survey area, the small acreage that supports native trees and shrubs generally is on the flood plains along the Belle Fourche and Cheyenne Rivers and along the larger intermittent drainageways. The soils that support trees are not classified as woodland soils. Nearly all of the wooded areas provide habitat for wildlife and protection for domestic animals.

Scattered individual plants or clumps of Rocky Mountain juniper grow on the Samsil soils on north- and east-facing slopes. Green ash, American elm, American plum, common chokecherry, silver buffaloberry, western snowberry, and several species of wild rose commonly grow in the draws associated with Cabbart and Delridge soils. Plains cottonwood, sandbar willow, and peachleaf willow grow in scattered clumps or groves on alluvial soils, such as Havre and Lohmiller soils, along the Belle Fourche and Cheyenne Rivers.

The early settlers valued the woody vegetation as a source of fuel and food. Currently, the native trees and shrubs are used chiefly for wildlife habitat.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

A *windbreak suitability group* is a distinctive group of soils that supports trees and shrubs having similar growth and survival rates if weather conditions are normal and the windbreak is properly managed. The relationship between the soils and the growth of trees and shrubs was ascertained during this survey. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the growth of trees and shrubs. Soil reaction, salt content, and a seasonal high water table are important. At the end of each map unit description, the soils have been assigned to a windbreak suitability group. Detailed information about each group is available in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

Grazing is extremely damaging to windbreaks and environmental plantings because the livestock compact the soil and remove the lower branches of the trees and shrubs. Removal of the lower branches reduces the effectiveness of the windbreaks. Grasses and weeds prevent maximum growth. Clean cultivation and applications of herbicide help to control weeds. Fallowing a year before planting helps to provide a reserve supply of moisture, which is needed before the seedlings can be established. On Marmarth, Twilight, and other soils that are susceptible to wind erosion, the site should be prepared in the spring, so that it is not exposed to wind erosion during the winter.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Wildlife Habitat

Connie M. Vicuna, biologist, Soil Conservation Service, helped write this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Most of this survey area is used as range. Only 14 percent of the acreage is used for agricultural crops. Because of the land use pattern, much of the original wildlife habitat in the area has been maintained. Many of the original wildlife species are throughout the survey area, though in less abundance. Rangeland wildlife species are dominant. These include antelope, mule deer, sharp-tailed grouse, sage grouse, prairie chicken, jackrabbit, and lark bunting and other grassland songbirds. Prairie dogs are abundant throughout the area. Common predators include coyote, bobcat, fox, badger, raccoon, golden eagles, ferruginous hawks, and rattlesnakes. The population of other species, such as whitetail deer, ring-necked pheasant, and gray partridge, has increased as a result of cultivation.

Woody habitat in this survey area is mainly on flood plains, along drainageways, and in draws on breaks in the uplands. While not abundant, these scattered shrubs and trees are very important for many rangeland species, either as a food source or as cover. Magpie, porcupine, mink, and beaver almost exclusively inhabit the wooded areas.

Fishing opportunities are very limited in the survey area. The Cheyenne River is a perennial stream. Sulphur and Elm Creeks and other creeks flow intermittently. Stock water impoundments are abundant throughout the area. Most of these have been stocked and thus provide fishing opportunities.

The stock water impoundments provide nearly all of the wetland habitat in the survey area. They are important breeding and rearing areas for waterfowl. They also provide watering sites for many kinds of wildlife.

Because the acreage of cropland is small and widely scattered, the entire survey area is well suited to rangeland wildlife habitat. Soil associations can be used to provide some indication of the distribution and density of wildlife and their habitat. The 11 associations in the survey area are described under the heading "General Soil Map Units."

Antelope and mule deer are throughout the survey area. Antelope are most abundant in the open and flatter areas of the Lawther-Abor, Lismas-Pierre-Swanboy, Gerdrum-Absher-Loburn, and Bullock-Parchin associations. Mule deer frequent the steep areas and wooded draws characteristic of the Samsil and Cabbart-Delridge associations. Sharp-tailed grouse are most abundant in the Lawther-Abor, Assinniboine-Blackhall-Twilight, Cabbart-Delridge, Eapa-Delridge, and Eapa-Tanna-Savo associations. These associations support tall grasses and scattered shrubs. Whitetail deer are in areas near cropland in the Lohmiller-Glenberg, Nunn-Satanta, Eapa-Delridge, and Eapa-Tanna-Savo associations.

The clayey soils in the Lismas-Pierre-Swanboy association and the sodium affected soils in the Gerdrum-Absher-Loburn and Bullock-Parchin associations are well suited to rangeland wildlife habitat. A large acreage of these associations is rangeland. Because of favorable growing conditions, the soils in the Lohmiller-Glenberg, Eapa-Delridge, and Eapa-Tanna-Savo associations are suitable for the development of food plots, cover areas of tame grasses and legumes, and woody habitat for cropland wildlife.

In table 8, the soils in the survey area are rated according to their potential for providing specific elements of wildlife habitat. This information can be used n planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat. The ratings, described in he following paragraphs, indicate the ease of establishing and maintaining these elements.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element is easily established, improved, or maintained. Few or no imitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element can be established, improved, or maintained in most places. Moderately intensive management is equired for satisfactory results. A rating of *poor* ndicates that limitations are severe for the designated lement. The element can be established, improved, or maintained in most places, but management is difficult nd must be intensive. A rating of *very poor* indicates hat restrictions for the element are very severe and that unsatisfactory results can be expected. Establishing, improving, or maintaining the element is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are sorghum, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are crested wheatgrass, intermediate wheatgrass, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestems, goldenrod, beggarweed, wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are bur oak, green ash, and common chokecherry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American plum, Russian-olive, silver buffaloberry, and Siberian crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

Information concerning the habitat elements needed to maintain and manage specific wildlife species can be obtained from the local office of the Soil Conservation Service or from the South Dakota Department of Game, Fish and Parks.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same o similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and loca roads and streets. The limitations are considered *slight* i soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary Facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

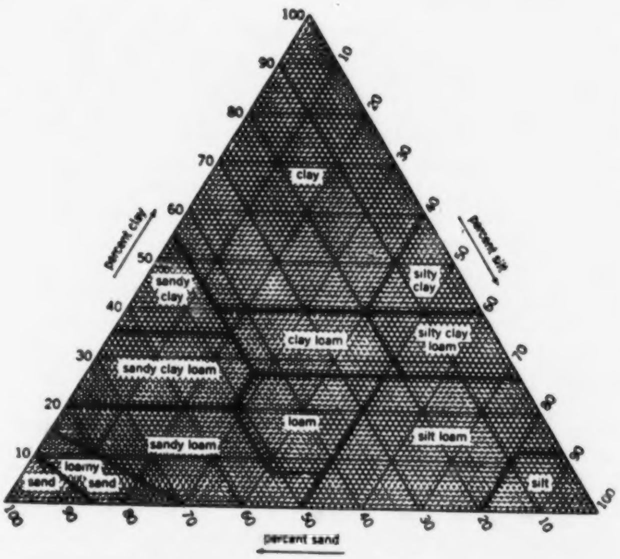

Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 16 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Torrifluvents (*Torr*, meaning hot and dry, plus *fluvent*, the suborder of the Entisols that is on a flood plain).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Ustic* identifies the subgroup that has more available moisture than is typical for the great group. An example is Ustic Torrifluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Abor Series

The Abor series consists of moderately deep, well drained, calcareous soils formed in clayey residuum on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is slow. Slopes range from 2 to 9 percent.

Abor soils are similar to Lawther and Pierre soils and commonly are near Delridge, Lawther, Tanna, and Yawdim soils. Delridge and Yawdim soils are on ridges and side slopes above the Abor soils. Delridge soils contain more sand and silt and less clay throughout than the Abor soils. Yawdim soils are 10 to 20 inches deep over soft bedrock. Lawther, Pierre, and Tanna soils are in positions on the landscape similar to those of the Abor soils. Lawther soils are more than 40 inches deep over soft bedrock. Pierre soils contain more clay throughout than the Abor soils. Tanna soils are more than 11 inches deep to free carbonates.

Typical pedon of Abor silty clay, 2 to 6 percent slopes, 2,000 feet south and 1,700 feet west of the northeast corner of sec. 29, T. 8 N., R. 16 E.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; very fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear wavy boundary.

Bw—5 to 17 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm; strong effervescence; mildly alkaline; gradual wavy boundary.

BCk—17 to 22 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—22 to 27 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure; hard, firm; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—27 to 60 inches; light yellowish brown (2.5Y 6/3) shale, light olive brown (2.5Y 5/3) moist; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 18 to 35 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It dominantly is silty clay but in some pedons is clay. It is 5 to 8 inches thick. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is silty clay or clay. The C horizon has hue of 2.5Y or 5Y, value of 6 or 7 (4 to 6 moist), and chroma of 2 or 3. It is clay or silty clay.

Absher Series

The Absher series consists of deep, well drained soils formed in silty and clayey alluvium on terraces and uplands. Permeability is very slow. Slopes range from 2 to 6 percent.

Absher soils are similar to Gerdrum soils and commonly are near Bullock, Delridge, Gerdrum, and Loburn soils. Bullock, Gerdrum, and Loburn soils are in positions on the landscape similar to those of the Absher soil. Bullock soils have less clay in the subsoil than the Absher soils. Visible salts are deeper in the subsoil of Gerdrum soils than in that of the Absher soils. The surface soil of Loburn soils is thicker than that of the Absher soils. Delridge soils do not have a natric horizon. They are higher on the landscape than the Absher soils.

Typical pedon of Absher silt loam, in an area of Absher-Slickspots complex, 2 to 6 percent slopes, 1,820 feet east and 1,100 feet south of the northwest corner of sec. 17, T. 8 N., R. 16 E.

E—0 to 2 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak very thin and thin platy structure parting to weak very fine and fine granular; hard, very friable; many very fine and fine roots; neutral; abrupt wavy boundary.

Bt—2 to 6 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong medium and coarse columnar structure parting to moderate medium blocky; very hard, firm, sticky and plastic; shiny surfaces on faces of peds; many very fine and fine roots; neutral; abrupt wavy boundary.

Btz—6 to 12 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; shiny surfaces on faces of peds; common very fine and fine roots; few fine crystals of gypsum and other salts; slight effervescence; moderately alkaline; clear wavy boundary.

BCz—12 to 19 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak medium and coarse blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few fine accumulations of gypsum and other salts; strong effervescence; moderately alkaline; clear wavy boundary.

Cz—19 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; common fine accumulations of gypsum and other salts; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 11 to 40 inches. In some pedons free carbonates are leached to a depth of 15 inches. The depth to gypsum and other salts ranges from 6 to 15 inches.

The E horizon has hue of 2.5Y or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3. It is 1 to 4 inches thick. The Bt horizon has hue of 2.5Y or 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It is silty clay or clay. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 or 3.

Assinniboine Series

The Assinniboine series consists of deep, well drained soils formed in loamy material on uplands. Permeability is moderate. Slopes range from 2 to 9 percent.

Assinniboine soils are similar to Eapa, Marmarth, and Twilight soils and commonly are near Blackhall soils. Blackhall soils are 10 to 20 inches deep over soft bedrock. They are on ridges and side slopes. Eapa soils contain more clay in the subsoil than the Assinniboine soils. Marmarth and Twilight soils are 20 to 40 inches deep over soft bedrock.

Typical pedon of Assinniboine fine sandy loam, 2 to 6 percent slopes, 2,475 feet south and 2,475 feet west of the northeast corner of sec. 3, T. 8 N., R. 11 E.

A—0 to 7 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many roots; neutral; clear smooth boundary.

Bt—7 to 16 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; common roots; shiny surfaces on faces of peds; neutral; gradual wavy boundary.

BCk—16 to 26 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; hard, friable; few roots; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C—26 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable; few roots to a depth of 30 inches; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 22 to 35 inches. The depth to free carbonates ranges from 14 to 22 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 moist), and chroma of 2 or 3. It is 6 to 8 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 3 or 4. It is fine sandy loam or sandy clay loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is fine sandy loam or sandy loam.

Attewan Series

The Attewan series consists of well drained soils that are moderately deep over gravelly material. These soils formed in alluvial sediments on terraces. Permeability is moderate above the gravelly material and very rapid in the gravelly material. Slopes range from 4 to 8 percent.

Attewan soils are similar to Eapa and Satanta soils and commonly are near Nihill, Nunn, and Satanta soils. Eapa, Nunn, and Satanta soils are in positions on the landscape similar to those of the Attewan soils. They are more than 40 inches deep to gravelly material. Nihill soils are less than 10 inches deep to gravelly material. They generally are on terrace escarpments below the Attewan soils.

Typical pedon of Attewan loam, in an area of Nihill-Attewan complex, 4 to 20 percent slopes, 630 feet east and 1,260 feet north of the southwest corner of sec. 34, T. 8 N., R. 14 E.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

Bt—4 to 12 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; shiny surfaces on faces of peds; common fine roots; neutral; abrupt wavy boundary.

BCk—12 to 16 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; common fine roots; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Ck—16 to 28 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few fine roots; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

2C—28 to 60 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose; few fine roots; carbonates on the underside of pebbles; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 10 to 21 inches. The depth to gravelly material ranges from 20 to 40 inches.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 moist), and chroma of 2 or 3. It is 4 to 7 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is sandy clay loam, clay loam, or loam. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 or 3. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 4. It is very gravelly loamy sand or gravelly sand.

Bankard Series

The Bankard series consists of deep, somewhat excessively drained, calcareous soils formed in sandy alluvium on flood plains. Permeability is rapid or very rapid. Slopes range from 0 to 4 percent.

Bankard soils commonly are near Glenberg and Lohmiller soils. The adjacent soils are slightly higher on the landscape than the Bankard soils. Also, they contain more silt and clay throughout.

Typical pedon of Bankard loamy fine sand, 940 feet north and 1,110 feet west of the southeast corner of sec. 36, T. 7 N., R. 17 E.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; loose; very friable; many roots; slight effervescence; mildly alkaline; abrupt wavy boundary.

C1—4 to 12 inches; light brownish gray (10YR 6/2) fine sand stratified with fine sandy loam; dark grayish brown (10YR 4/2) moist; single grain; loose; few roots; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—12 to 60 inches; light brownish gray (10YR 6/2) fine sand stratified with fine sandy loam; dark grayish brown (10YR 4/2) moist; single grain; loose; slight effervescence; moderately alkaline.

Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4. It is 4 to 8 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 to 6 moist), and chroma of 2 to 4. It is stratified with fine sandy loam, sandy loam, loamy sand, and loamy fine sand. Gravelly loamy sand layers are in some pedons.

Bankard gravelly loamy sand contains more gravel than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Blackhall Series

The Blackhall series consists of shallow, well drained, calcareous soils formed in loamy residuum on uplands. Permeability is moderately rapid. Slopes range from 9 to 40 percent.

These soils are at lower elevations and have a somewhat longer growing season than is definitive for the series. These differences, however, do not significantly alter the usefulness or behavior of the soils.

Blackhall soils are similar to Cabbart soils and commonly are near Bullock, Cabbart, and Twilight soils. Bullock soils have a natric horizon. They are in small pits and depressions. Cabbart soils contain less sand than the Blackhall soils. Twilight soils are 20 to 40 inches deep over soft bedrock. They are lower on the landscape than the Blackhall soils.

Typical pedon of Blackhall fine sandy loam, in an area of Blackhall-Twilight fine sandy loams, 9 to 40 percent slopes, 660 feet north and 165 feet west of the southeast corner of sec. 31, T. 12 N., R. 16 E.

A—0 to 5 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and very fine granular structure; slightly hard, very friable; many roots; slight effervescence; mildly alkaline; clear wavy boundary.

C—5 to 11 inches; olive (5Y 5/3) fine sandy loam, olive (5Y 4/3) moist; massive; slightly hard, very friable; common roots; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—11 to 60 inches; pale olive (5Y 6/3) weakly cemented sandstone, olive (5Y 5/3) moist; slightly hard, very friable; few roots between fractures to a depth of 30 inches; violent effervescence; moderately alkaline.

The depth to soft bedrock ranges from 10 to 20 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer.

The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4. It is 3 to 5 inches thick. The C horizon has hue of 5Y or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 6. It is fine sandy loam or sandy loam. The Cr horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 8 (3 to 7 moist), and chroma of 1 to 4. It is soft sandstone, siltstone, or clayey shale. Some layers in this horizon do not have free carbonates.

Bullock Series

The Bullock series consists of moderately deep, well drained soils formed in loamy residuum on uplands. Permeability is very slow or slow. Slopes range from 0 to 20 percent.

Bullock soils commonly are near the Absher, Blackhall, Gerdrum, and Parchin soils. Absher and Gerdrum soils are in positions on the landscape similar to those of the Bullock soils. They are more than 40 inches deep over bedrock. The shallow Blackhall soils do not have a natric horizon. They are on ridges. Parchin soils have a surface soil that is thicker than that of the Bullock soils. Also, they are slightly higher on the landscape.

Typical pedon of Bullock fine sandy loam, in an area of Bullock-Parchin fine sandy loams, 0 to 4 percent slopes, 1,120 feet south and 60 feet west of the northeast corner of sec. 12, T. 12 N., R. 17 E.

E—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure; soft, very friable; many fine roots; slightly acid; abrupt wavy boundary.

Bt—4 to 9 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium and coarse columnar structure parting to weak medium subangular blocky; grayish brown (10YR 5/2) coatings on the tops of the columns; very hard, friable; shiny surfaces on faces of peds; many fine flat roots; mildly alkaline; clear wavy boundary.

BCkz—9 to 13 inches; grayish brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; shiny surfaces on faces of peds; few fine accumulations of carbonate; many fine accumulations of gypsum and other salts; slight effervescence; moderately alkaline; clear wavy boundary.

Ckz—13 to 22 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; common fine and medium accumulations of carbonate; common fine accumulations of gypsum and other salts; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—22 to 60 inches; light gray (5Y 7/2) soft sandstone interbedded with siltstone; light olive gray (5Y 6/2) moist; brownish yellow (10YR 6/8) stains of iron and manganese between bedding planes; strong effervescence; moderately alkaline.

The depth to soft bedrock ranges from 20 to 40 inches. The thickness of the solum ranges from 11 to 30 inches. Free carbonates are leached to a depth of 5 to 11 inches.

The E horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 or 4 moist), and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is loamy fine sand, very fine sandy loam, or loam. It is 2 to 4 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is sandy clay loam, loam, or clay loam. The C horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 6 moist), and chroma of 2 to 4. It is sandy loam, fine sandy loam, loam, or clay loam. Some pedons do not have a C horizon. The Cr horizon has hue of 2.5Y or 5Y, value of 5 to 7 (3 to 6 moist), and chroma of 2 or 3. It is soft sandstone, siltstone, or clayey shale. Some layers in this horizon do not have free carbonates.

Cabbart Series

The Cabbart series consists of shallow, well drained, calcareous soils formed in loamy residuum on uplands. Permeability is moderate. Slopes range from 9 to 40 percent.

Cabbart soils are similar to Blackhall and Cabbart Variant soils and commonly are near Bullock and Delridge soils. Blackhall soils contain more sand throughout than the Cabbart soils. Bullock soils have a natric horizon. They are in small pits and depressions. Cabbart Variant soils are 10 to 20 inches deep over hard bedrock. Delridge soils are 20 to 40 inches deep over soft bedrock. They are lower on the landscape than the Cabbart soils.

Typical pedon of Cabbart loam, in an area of Delridge-Cabbart loams, 6 to 15 percent slopes, 3,475 feet west and 1,435 feet north of the southeast corner of sec. 10, T. 11 N., R. 16 E.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; slightly hard, very friable; many roots; violent effervescence; mildly alkaline; clear wavy boundary.

Ck—3 to 15 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; weak coarse prismatic structure parting to weak very fine granular; slightly hard, very friable; many roots; many fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

Cr—15 to 60 inches; pale yellow (5Y 7/3) soft siltstone, olive (5Y 5/3) moist; few fine distinct iron stains, yellow (10YR 7/6) and brownish yellow (10YR 6/6) moist; strong effervescence; moderately alkaline.

The depth to soft bedrock ranges from 10 to 20 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It dominantly is loam but in some pedons is silt loam. It is 2 to 4 inches thick. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is loam or silt loam. The Cr horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 6 moist), and chroma of 1 to 4. It is soft sandstone, siltstone, or clayey shale. Some layers in this horizon do not have free carbonates.

Cabbart Variant

The Cabbart Variant consists of shallow, well drained, calcareous soils formed in loamy material over hard limestone. These soils are on uplands. Permeability is moderate. Slopes range from 2 to 6 percent.

Cabbart Variant soils are similar to Cabbart soils and are near Cabbart and Eapa soils. Cabbart soils do not have a mollic epipedon and are 10 to 20 inches deep over soft bedrock. Eapa soils are more than 60 inches deep over soft bedrock. They are lower on the landscape than the Cabbart Variant soils.

Typical pedon of Cabbart Variant loam, 2 to 6 percent slopes, 1,815 feet east and 1,980 feet south of the northwest corner of sec. 18, T. 12 N., R. 14 E.

A—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak very fine and fine granular; slightly hard, friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

Bw—2 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; many fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

R—12 to 60 inches; white (10YR 8/1) fractured limestone.

The depth to limestone ranges from 5 to 20 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer.

The A horizon has hue of 10YR, value of 4 or 5 (3 moist), and chroma of 2. The Bw horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is loam or silt loam. The R horizon has hue of 10YR, value of 7 or 8 (6 or 7 moist), and chroma of 1 or 2. It is highly fractured in the upper part.

Delridge Series

The Delridge series consists of moderately deep, well drained, calcareous soils formed in loamy and silty residuum on uplands. Permeability is moderate. Slopes range from 2 to 15 percent.

Delridge soils commonly are near Cabbart, Eapa, Savo, and Tanna soils. Cabbart soils are 10 to 20 inches deep over soft bedrock. They are higher on the landscape than the Delridge soils. Eapa and Savo soils are lower on the landscape than the Delridge soils. They are more than 40 inches deep over soft bedrock. Tanna soils contain more clay throughout than the Delridge soils. They are in positions on the landscape similar to those of the Delridge soils.

Typical pedon of Delridge loam, in an area of Delridge-Cabbart loams, 6 to 15 percent slopes, 2,360 feet south and 475 feet west of the northeast corner of sec. 9, T. 7 N., R. 15 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

AC—3 to 9 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure; slightly hard, friable; many fine roots; strong effervescence; mildly alkaline; clear wavy boundary.

Ck—9 to 14 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak medium and coarse prismatic structure; hard, friable; common fine roots; many fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C—14 to 24 inches; light brownish gray (2.5Y 6/2) loam; grayish brown (2.5Y 5/2) moist; massive; hard, friable; few fine roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—24 to 60 inches; light gray (2.5Y 7/2) siltstone, grayish brown (2.5Y 5/2) moist; strong effervescence; moderately alkaline.

The depth to soft bedrock ranges from 20 to 40 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 moist), and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam, clay loam, or sandy clay loam. It is 1 to 4 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is loam, silt loam, or clay loam. The Cr horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 8 (3 to 7 moist), and chroma of 1 to 4. It is soft sandstone, siltstone, or clayey shale. In places some strata in this horizon do not have free carbonates.

Eapa Series

The Eapa series consists of deep, well drained soils formed in loamy material on uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Eapa soils are similar to Attewan, Assinniboine, Marmarth, and Satanta soils and commonly are near Delridge and Grail soils. Attewan soils are 20 to 40 inches deep over gravelly material. Assinniboine soils contain less clay and more sand in the subsoil than the Eapa soils. Delridge and Marmarth soils are higher on the landscape than the Eapa soils. They are 20 to 40 inches deep over soft bedrock. Grail soils contain more clay in the subsoil than the Eapa soils. They are in swales. Satanta soils are in a warmer part of the survey area than the Eapa soils.

Typical pedon of Eapa loam, 2 to 6 percent slopes, 630 feet east and 2,360 feet south of the northwest corner of sec. 23, T. 9 N., R. 12 E.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak very fine granular structure; soft, very friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—4 to 12 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, friable; common fine roots; slightly acid; clear wavy boundary.

Bt2—12 to 23 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable; shiny surfaces on faces of peds; common roots; neutral; abrupt wavy boundary.

BCk—23 to 37 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, very friable; shiny surfaces on faces of peds; few fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—37 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable; few fine roots in the upper part; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 23 to 40 inches. The depth to free carbonates ranges from 15 to 30 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It dominantly is loam but in some pedons is very fine sandy loam. It is 4 to 7 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is dominantly loam or clay loam, but it has thin layers of loamy sand and fine sandy loam in some pedons.

Gerdrum Series

The Gerdrum series consists of deep, well drained soils formed in alluvium on uplands and terraces. Permeability is slow. Slopes range from 0 to 4 percent.

Gerdrum soils are similar to Absher soils and commonly are near Absher, Bullock, Eapa, Loburn, and Lawther soils. Absher soils are shallower to visible salts than the Gerdrum soils. Bullock and Loburn soils are in positions on the landscape similar to those of the Gerdrum soils. Bullock soils contain less clay in the subsoil than the Gerdrum soils. The surface soil of Loburn soils is thicker than that of the Gerdrum soils. Eapa and Lawther soils do not have a natric horizon. They are higher on the landscape than the Gerdrum soils.

Typical pedon of Gerdrum loam, 0 to 4 percent slopes, 2,400 feet north and 500 feet east of the southwest corner of sec. 11, T. 10 N., R. 14 E.

E—0 to 4 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin and medium platy structure parting to weak very fine and fine granular; slightly hard, friable; many fine roots; neutral; abrupt smooth boundary.

Bt1—4 to 8 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse columnar structure parting to weak fine and medium blocky; very hard, firm, sticky and plastic; many fine roots; moderately alkaline; clear wavy boundary.

Bt2—8 to 15 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm, sticky and plastic; common fine roots; moderately alkaline; abrupt wavy boundary.

BCk—15 to 20 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium and coarse blocky; very hard, firm, sticky and plastic; few fine roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cz1—20 to 27 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; very hard, firm, slightly sticky and plastic; few very fine roots; few fine segregations of gypsum and other salts; strong effervescence; moderately alkaline; gradual wavy boundary.

Cz2—27 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, slightly sticky and plastic; common fine accumulations of gypsum and other salts; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to accumulated gypsum range from 15 to 24 inches. The E horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 or 3. It dominantly is loam but in some pedons is silt loam. It is 2 to 4 inches thick. Some pedons have an A horizon, which is less than 2 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is clay loam, silty clay loam, or clay. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is dominantly clay loam or clay, but it has thin strata of loam or sandy loam in some pedons.

Glenberg Series

The Glenberg series consists of deep, well drained, calcareous soils formed in loamy and sandy alluvium on flood plains. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Glenberg soils are similar to Havre soils and commonly are near Bankard and Lohmiller soils. Bankard soils contain more sand and less silt and clay between depths of 10 and 40 inches than the Glenberg soils. They are adjacent to the streams. Havre and Lohmiller soils contain more silt and clay and less sand between depths of 10 and 40 inches than the Glenberg soils. Also, Lohmiller soils are slightly higher on the flood plains.

Typical pedon of Glenberg fine sandy loam, 2,364 feet west and 788 feet south of the northeast corner of sec. 1, T. 6 N., R. 17 E.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; slight effervescence; mildly alkaline; clear wavy boundary.

C—4 to 60 inches; grayish brown (10YR 5/2) fine sandy loam that has thin layers of loamy fine sand; dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; many fine roots; slight effervescence; mildly alkaline.

Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer. The A horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is sandy loam. It is 4 to 8 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly fine sandy loam or sandy loam, but layers of silt loam, loamy fine sand, and gravelly loamy sand are common.

Grail Series

The Grail series consists of deep, well drained soils formed in local alluvium in swales and on broad flats in the uplands. Permeability is moderately slow. Slopes range from 0 to 9 percent.

Grail soils commonly are near Assinniboine, Delridge, and Eapa soils. Assinniboine and Eapa soils are slightly higher on the landscape than the Grail soils. Also, they contain more sand in the subsoil. They have a mollic epipedon that is less than 16 inches thick. Delridge soils are 20 to 40 inches deep to soft bedrock. They are on the steeper parts of the landscape.

Typical pedon of Grail silt loam, 395 feet north and 1,575 feet west of the southeast corner of sec. 13, T. 8 N., R. 14 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; hard, friable; few roots; slightly acid; abrupt smooth boundary.

A—6 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

Bt—8 to 21 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; shiny surfaces on faces of peds; common fine roots; neutral; abrupt wavy boundary.

BCk—21 to 28 inches; pale brown (10YR 6/3) clay, dark brown (10YR 3/3) moist; weak medium and coarse prismatic structure parting to weak fine and medium blocky; very hard, firm; shiny surfaces on faces of peds; common fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1—28 to 40 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few fine roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; hard, friable; few fine roots; few fine concretions of carbonate; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 15 to 40 inches. The thickness of the mollic epipedon ranges from 16 to 30 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silt loam but in some pedons is clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It is clay loam or clay. The content of clay in this horizon ranges from 35 to 45 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It is loam, silt loam, clay loam, or silty clay loam.

Havre Series

The Havre series consists of deep, well drained soils formed in calcareous, loamy alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Havre soils are similar to Glenberg soils and commonly are near Assinniboine, Eapa, Glenberg, Lawther, and Lohmiller soils. Assinniboine, Eapa, and Lawther soils are on uplands. They are not stratified and have a mollic epipedon. Glenberg soils contain more sand and less silt and clay throughout than the Havre soils. Lohmiller soils contain more clay throughout than the Havre soils. They are in positions on the landscape similar to those of the Havre soils.

Typical pedon of Havre loam, channeled, 2,080 feet west of the southeast corner of sec. 8, T. 9 N., R. 14 E.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; slightly hard, very friable; many roots; slight effervescence; mildly alkaline; clear wavy boundary.

C1—5 to 10 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; common roots; slight effervescence; mildly alkaline; clear wavy boundary.

C2—10 to 60 inches; light brownish gray (2.5Y 6/2) loam that has thin layers of fine sandy loam and very fine sandy loam; dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; few roots; slight effervescence; moderately alkaline.

Free carbonates are typically throughout the profile, but in some pedons they are not evident in the surface layer. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 moist), and chroma of 2. It dominantly is loam but in some pedons is silt loam. It is 5 to 8 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2. It dominantly is loam or silt loam, but it has thin layers of fine sandy loam, very fine sandy loam, and clay loam in some pedons. Some pedons have a buried A horizon.

Heil Series

The Heil series consists of deep, poorly drained soils formed in clayey local alluvium in depressions on uplands. Permeability is very slow. Slopes are less than 1 percent.

Heil soils commonly are near the well drained Eapa, Satanta, and Savo soils. The adjacent soils are higher on the landscape than the Heil soils.

Typical pedon of Heil silty clay loam, 2,500 feet west and 1,000 feet south of the northeast corner of sec. 24, T. 7 N., R. 17 E.

E—0 to 3 inches; light gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; weak thin platy structure parting to weak medium and fine granular; hard, firm; common roots; slightly acid; abrupt wavy boundary.

Bt1—3 to 14 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; moderate coarse columnar structure parting to weak medium and coarse blocky; very hard, very firm, sticky and plastic; shiny surfaces on faces of peds; common roots; neutral; gradual wavy boundary.

Bt2—14 to 20 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; weak coarse prismatic structure; very hard, very firm, sticky and plastic; common roots; neutral; gradual wavy boundary.

BCkg—20 to 28 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; very hard, very firm, sticky and plastic; few fine accumulations of carbonate; slight effervescence; mildly alkaline; clear wavy boundary.

Ckg—28 to 60 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; very hard, very firm; many fine accumulations of carbonate; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 9 to 30 inches. The depth to free carbonates ranges from 15 to 30 inches.

The E horizon has hue of 10YR to 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1. The Bt horizon has hue of 10YR to 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. It is silty clay or clay. The Ckg horizon has hue of 2.5Y or 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. It is silty clay or clay.

Hisle Series

The Hisle series consists of moderately deep, well drained soils formed in clayey residuum on uplands. Permeability is very slow. Slopes range from 0 to 4 percent.

Hisle soils commonly are near Kyle and Pierre soils. The adjacent soils do not have a natric horizon. Kyle soils are in positions on the landscape similar to those of the Hisle soils. Pierre soils are on the higher, convex parts of the landscape.

Typical pedon of Hisle silt loam, in an area of Hisle-Slickspots complex, 0 to 4 percent slopes, 1,100 feet west and 1,300 feet south of the northeast corner of sec. 1, T. 8 N., R. 17 E.

E—0 inches to 1 inch; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak thin and medium platy structure parting to weak very fine and fine granular; slightly hard, friable; common roots; neutral; abrupt smooth boundary.

Bt1—1 to 4 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse columnar structure parting to weak medium and coarse blocky; hard, firm; common roots; mildly alkaline; clear wavy boundary.

Bt2—4 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse angular blocky; hard, firm; moderately alkaline; clear wavy boundary.

BC—8 to 11 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; hard, firm; few roots; strong effervescence; moderately alkaline; clear wavy boundary.

C—11 to 20 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm; few roots; strong effervescence; strongly alkaline; clear wavy boundary.

Cyz—20 to 28 inches; light gray (2.5Y 7/2) clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm; few fine faint nests of gypsum and other salts; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—28 to 60 inches; light gray (2.5Y 7/2) shale, grayish brown (2.5Y 5/2) moist; hard, firm; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 6 to 26 inches. The depth to free carbonates ranges from 4 to 12 inches. The depth to shale bedrock ranges from 20 to 40 inches.

The E horizon has hue of 10YR or 2.5Y, value of 5 to 8 (3 to 5 moist), and chroma of 1 or 2. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. The C horizon has hue of 2.5Y or 5Y, value of 5 to 8 (3 to 5 moist), and chroma of 1 to 3. It is silty clay or clay.

Kyle Series

The Kyle series consists of deep, well drained soils formed in clayey material on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 6 percent.

Kyle soils are similar to Abor, Lawther, and Pierre soils and commonly are near Lohmiller, Pierre, Samsil, and Swanboy soils. Abor and Pierre soils are 20 to 40 inches deep over shale. Lawther soils have a mollic epipedon. Lohmiller soils are stratified throughout. They are on flood plains. Samsil soils are 10 to 20 inches deep over shale. They are on the steeper ridges. Swanboy soils are shallower to accumulations of salts than the Kyle soils. They are in positions on the landscape similar to those of the Kyle soils.

Typical pedon of Kyle clay, 2 to 6 percent slopes, 1,600 feet west and 530 feet south of the northeast corner of sec. 35, T. 8 N., R. 10 E.

A—0 to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; many roots; neutral; abrupt smooth boundary.

Bw—2 to 16 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak coarse and medium prismatic structure parting to weak coarse and medium blocky; very hard, firm, sticky and plastic; common roots; slight effervescence; mildly alkaline; gradual wavy boundary.

BC—16 to 22 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; weak coarse and medium subangular blocky structure parting to weak coarse and medium blocky; very hard, firm, sticky and plastic; few roots; slight effervescence; mildly alkaline; gradual wavy boundary.

BCy—22 to 40 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; weak coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; few roots; common medium nests of gypsum; slight effervescence; mildly alkaline; gradual wavy boundary.

C—40 to 60 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; massive; very hard, firm, sticky and plastic; few medium nests of gypsum; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 18 to 40 inches. Some pedons are calcareous at the surface.

The A horizon has hue of 2.5Y or 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 to 3. It is 2 to 5 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. The C horizon has hue of 2.5Y or 5Y and value of 5 or 6 (4 or 5 moist).

Lardell Series

The Lardell series consists of deep, somewhat poorly drained, saline soils formed in loamy alluvium on flood plains. Permeability is slow. Slopes range from 0 to 4 percent.

Lardell soils commonly are near the well drained Blackhall and Bullock soils. The shallow Blackhall soils are on the steeper ridges. Bullock soils have a natric horizon. They are in small pits and depressions on uplands.

Typical pedon of Lardell fine sandy loam, 660 feet east and 825 feet north of the southwest corner of sec. 31, T. 12 N., R. 10 E.

A—0 inches to 1 inch; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak thin platy structure; slightly hard, very friable; few roots; many fine accumulations of salts; slight effervescence; strongly alkaline; abrupt wavy boundary.

Cz1—1 to 11 inches; light gray (5Y 7/2) sandy clay loam, olive (5Y 5/3) moist; few prominent olive (5Y 5/8) and strong brown (7.5YR 5/8) mottles; massive; hard, friable; few roots; many fine accumulations of salts; strong effervescence; strongly alkaline; gradual wavy boundary.

Cz2—11 to 17 inches; light gray (5Y 7/2) sandy loam, light olive gray (5Y 6/2) moist; massive; few fine prominent strong brown (7.5YR 5/8) mottles; friable; few roots; many fine accumulations of salts; strong effervescence; strongly alkaline; gradual wavy boundary.

Cz3—17 to 52 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; few fine prominent strong brown (7.5YR 5/8) mottles; massive; hard, friable; few roots; many fine accumulations of salts; strong effervescence; strongly alkaline; gradual wavy boundary.

C—52 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; many fine and medium prominent yellowish red (5YR 4/8) mottles; massive; hard, friable; common fine accumulations of salts; slight effervescence; strongly alkaline.

Free carbonates and visible salts typically are throughout the profile, but in some pedons they are not evident in the surface layer. The A horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 to 6 moist), and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is loam. It is 1 to 3 inches thick. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is stratified clay loam, silty clay loam, loam, sandy loam, or fine sandy loam.

Lawther Series

The Lawther series consists of deep, well drained soils formed in clayey material on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is slow. Slopes range from 2 to 6 percent.

Lawther soils are similar to Abor, Kyle, and Pierre soils and commonly are near Abor, Absher, and Yawdim soils. Abor and Pierre soils are 20 to 40 inches deep over shale. Absher soils have a natric horizon. They are in small pits and depressions on the lower parts of the landscape. Kyle soils contain more clay throughout than the Lawther soil. Yawdim soils are 10 to 20 inches deep over shale. They are on ridges.

Typical pedon of Lawther silty clay, 2 to 6 percent slopes, 200 feet west and 830 feet north of the southeast corner of sec. 25, T. 8 N., R. 16 E.

Ap—0 to 6 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate very fine and fine granular structure; slightly hard, friable, sticky and plastic; common roots; neutral; abrupt smooth boundary.

Bw—6 to 13 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; common roots; strong effervescence; moderately alkaline; clear smooth boundary.

Bk—13 to 21 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium blocky; hard, firm, sticky and plastic; few roots; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

BCk—21 to 26 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm, sticky and plastic; few roots; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Cky—26 to 60 inches; light brownish gray (2.5Y 6/3) silty clay, grayish brown (2.5Y 5/3) moist; massive; hard, firm, sticky and plastic; many fine accumulations of carbonate; many fine accumulations of gypsum; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 35 inches. The depth to free carbonates ranges from 3 to 12 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay but in some pedons is clay. It is 5 to 8 inches thick. The Bw horizon has hue of 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2. It is silty clay or clay. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It is silty clay or silty clay loam.

Lismas Series

The Lismas series consists of shallow, well drained soils formed in clayey residuum on uplands. Permeability is very slow. Slopes range from 6 to 40 percent.

Lismas soils are similar to Samsil and Yawdim soils and commonly are near Kyle, Pierre, and Winler soils. Kyle soils are more than 40 inches deep over clayey shale. They are on long, smooth slopes below the Lismas soils. Pierre and Winler soils are lower on the landscape than the Lismas soils. They are 20 to 40 inches deep over clayey shale. Samsil soils have free carbonates at or near the surface. Yawdim soils contain less clay throughout than the Lismas soils.

Typical pedon of Lismas clay, 15 to 40 percent slopes, 770 feet north and 1,805 feet west of the southeast corner of sec. 35, T. 8 N., R. 10 E.

A—0 to 3 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; weak fine and very fine granular structure; very hard, very firm, very sticky and very plastic; many roots; slightly acid; clear smooth boundary.

C1—3 to 8 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; weak medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; many roots; slightly acid; clear wavy boundary.

C2—8 to 11 inches; light olive gray (5Y 6/2) shaly clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; many roots; about 50 percent shale fragments; medium acid; gradual wavy boundary.

Cr—11 to 60 inches; light olive gray (5Y 6/2) shale, olive gray (5Y 5/2) moist; pale yellow (2.5Y 8/4) and yellowish brown (10YR 5/6) stains along bedding planes; few roots along the bedding planes and fractures in the upper 15 inches; medium acid.

The depth to shale ranges from 8 to 17 inches. The A horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is 3 to 5 inches thick.

The C horizon has hue of 2.5Y or 5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 or 3. It is clay or shaly clay. The Cr horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3.

Loburn Series

The Loburn series consists of deep, well drained soils formed in clayey, loamy, and silty alluvium on uplands and terraces. Permeability is very slow. Slopes range from 0 to 3 percent.

Loburn soils are similar to Parchin soils and commonly are near Absher, Cabbart, Gerdrum, Marmarth, and Parchin soils. Absher and Gerdrum soils are in small pits and depressions. They are slightly lower on the landscape than the Loburn soils. Also, they have thinner A and E horizons. Cabbart soils are 10 to 20 inches deep over soft bedrock. They are on ridges above the Loburn soils. Marmarth soils do not have a natric horizon. They are slightly higher on the landscape than the Loburn soils. Parchin soils contain less clay in the subsoil than the Loburn soils.

Typical pedon of Loburn loam, in an area of Loburn-Gerdrum complex, 0 to 3 percent slopes, 150 feet east and 2,380 feet north of the southwest corner of sec. 22, T. 8 N., R. 11 E.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak very fine granular; soft, very friable; many fine roots; slightly acid; abrupt smooth boundary.

E—3 to 8 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak very fine granular; soft, very friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt—8 to 16 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate medium columnar structure parting to moderate medium and fine blocky; hard, firm, sticky and plastic; common fine roots; shiny surfaces on faces of peds; slightly acid; gradual wavy boundary.

Bkz1—16 to 24 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium and fine blocky; hard, firm, sticky and plastic; few fine roots; shiny surfaces on peds; few fine accumulations of gypsum and other salts; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bkz2—24 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; hard, firm, sticky and plastic; few fine accumulations of gypsum and other salts; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Ckz—36 to 60 inches; light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, sticky and plastic; few fine accumulations of gypsum and other salts; few fine accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to carbonates ranges from 13 to 25 inches. Few to many accumulations of gypsum crystals and other salts are in the B and C horizons.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. It dominantly is loam but in some pedons is silt loam. It is 3 to 6 inches thick. The E horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 1 to 3. It is loam or silt loam. It is 3 to 5 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is clay, silty clay, silty clay loam, or clay loam. The clay content in this horizon ranges from 35 to 50 percent. The Bk and Bz horizons have hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. They are silty clay loam, clay loam, silty clay, or clay. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is silty clay loam, sandy clay loam, or clay loam.

Lohmiller Series

The Lohmiller series consists of deep, well drained, calcareous soils formed in clayey, loamy, and silty alluvium on flood plains. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Lohmiller soils are similar to Stetter soils and commonly are near Glenberg, Kyle, and Stetter soils. Glenberg soils contain more sand throughout than the Lohmiller soils. Also, they are slightly lower on the flood plain. Kyle soils are not stratified and contain more clay throughout than the Lohmiller soils. They are on fans and foot slopes and are slightly higher on the landscape than the Lohmiller soils. Stetter soils contain more clay throughout than the Lohmiller soils.

Typical pedon of Lohmiller silty clay loam, channeled, 315 feet north and 945 feet east of the southwest corner of sec. 11, T. 6 N., R. 16 E.

A—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin and medium platy structure parting to weak fine and medium granular; hard, friable, slightly sticky and slightly plastic; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C1—4 to 23 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin bedding planes; common fine and medium roots; slight effervescence; mildly alkaline; clear wavy boundary.

C2—23 to 40 inches; grayish brown (2.5Y 5/2) stratified clay loam and sandy loam, dark grayish brown (2.5Y 4/2) moist; slightly hard, very friable; few medium roots; strong effervescence; mildly alkaline; abrupt wavy boundary.

C3—40 to 60 inches; light brownish gray (2.5Y 6/2) stratified silty clay loam, clay, and sandy loam, dark grayish brown (2.5Y 4/2) moist; hard, friable; strong effervescence; mildly alkaline.

Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer. The A horizon has hue of 10YR to 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It dominantly is silty clay loam but in some pedons is clay loam. The C horizon has hue of 10YR to 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is stratified sandy loam to clay.

Marmarth Series

The Marmarth series consists of moderately deep, well drained soils formed in loamy residuum on uplands. Permeability is moderate. Slopes range from 4 to 9 percent.

Marmarth soils are similar to Assinniboine, Attewan, Eapa, and Satanta soils and commonly are near Bullock, Parchin, and Twilight soils. Assinniboine, Eapa, and Satanta soils do not have soft bedrock within a depth of 40 inches. Attewan soils are 20 to 40 inches deep over gravelly material. Bullock and Parchin soils are slightly lower on the landscape than the Assinniboine soils. They have a natric horizon. Twilight soils contain more sand in the subsoil than the Marmarth soils. They are in positions on the landscape similar to those of the Marmarth soils.

Typical pedon of Marmarth fine sandy loam, in an area of Twilight-Marmarth-Parchin fine sandy loams, 4 to 9 percent slopes, 478 feet south and 1,206 feet east of the northwest corner of sec. 4, T. 12 N., R. 17 E.

A—0 to 4 inches; brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; common fine and medium roots; neutral; clear smooth boundary.

Bt1—4 to 9 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; common fine and medium roots; neutral; gradual wavy boundary.

Bt2—9 to 16 inches; brown (10YR 5/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, slightly sticky and plastic; common fine roots; neutral; abrupt wavy boundary.

BCk—16 to 20 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and plastic; few fine roots; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

Ck—20 to 28 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; hard, friable; few fine roots; common fine accumulations of carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—28 to 60 inches; light gray (2.5Y 7/2) soft sandstone, grayish brown (2.5Y 5/2) moist; slightly hard, friable; few fine roots; few fine accumulations of carbonate in the bedrock fractures; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The depth to free carbonates ranges from 11 to 27 inches. The depth to bedrock ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 15 inches.

The A horizon has hue of 10YR, value of 4 or 5 (3 moist), and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is loam. It is 4 to 8 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. It is loam, clay loam, or sandy clay loam. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is fine sandy loam or loam. The Cr horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 8 (3 to 7 moist), and chroma of 1 to 4. It is soft sandstone, siltstone, or clayey shale.

Nihill Series

The Nihill series consists of well drained soils formed in gravelly alluvium on terraces. These soils are shallow over very gravelly material. Permeability is moderately rapid. Slopes range from 4 to 20 percent.

Nihill soils are near Attewan, Eapa, Nunn, and Satanta soils. The adjacent soils are higher on the landscape than the Nihill soils. Attewan soils are 20 to 40 inches deep over gravelly material. Eapa, Nunn, and Satanta soils are more than 40 inches deep over gravelly material.

Typical pedon of Nihill gravelly loam, in an area of Nihill-Attewan complex, 4 to 20 percent slopes, 1,920 feet north and 2,200 feet west of the southeast corner of sec. 6, T. 7 N., R. 14 E.

A—0 to 4 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; loose, very friable; many fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

Ck—4 to 60 inches; pale brown (10YR 6/3) and brown (10YR 5/3) very gravelly sandy loam, brown (10YR 5/3 and 4/3) moist; loose; many fine roots in the upper part; carbonate coatings on the underside of pebbles; violent effervescence; moderately alkaline.

The depth to very gravelly material is less than 10 inches. The A horizon has hue of 10YR, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. It typically is gravelly loam but in some pedons is gravelly fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is very gravelly loam or very gravelly sandy loam.

Nunn Series

The Nunn series consists of deep, well drained soils formed in clayey and loamy alluvium on high terraces. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Nunn soils are similar to Savo and Tanna soils and commonly are near Pierre, Samsil, and Satanta soils. Pierre and Tanna soils are 20 to 40 inches deep over shale. Pierre soils are lower on the landscape than the Nunn soils. Samsil soils are 10 to 20 inches deep over shale. They are on the steeper ridges. Satanta soils contain less clay throughout than the Nunn soils. They are in positions on the landscape similar to those of the Nunn soils. Savo soils contain more silt and less sand throughout than the Nunn soils.

Typical pedon of Nunn clay loam, 0 to 2 percent slopes, 1,733 feet west and 70 feet south of the northeast corner of sec. 20, T. 6 N., R. 16 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

BA—7 to 10 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; neutral; abrupt wavy boundary.

Bt1—10 to 16 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; shiny surfaces on faces of peds; neutral; gradual wavy boundary.

Bt2—16 to 26 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; shiny surfaces on faces of peds; mildly alkaline; abrupt smooth boundary.

BCk—26 to 36 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Ck—36 to 60 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, sticky and plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline.

Free carbonates are leached to a depth of 10 to 30 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It dominantly is clay loam but in some pedons is loam. It is 4 to 8 inches thick. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It is clay loam or clay. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is loam or clay loam.

Parchin Series

The Parchin series consists of moderately deep, well drained soils formed in loamy residuum on uplands. Permeability is very slow or slow. Slopes range from 0 to 6 percent.

Parchin soils are similar to Loburn soils and commonly are near Blackhall, Bullock, Cabbart, and Twilight soils. Blackhall and Cabbart soils are on ridges above the Parchin soils. They are 10 to 20 inches deep over soft bedrock. Bullock soils have a natric horizon at a depth of 4 inches or less. They are in small pits and depressions. Loburn soils contain more clay in the subsoil than the Parchin soils. Twilight soils are 20 to 40 inches deep over soft bedrock. They are on side slopes and are slightly higher on the landscape than the Parchin soils.

Typical pedon of Parchin fine sandy loam, in an area of Parchin-Bullock fine sandy loams, 2 to 6 percent slopes, 630 feet west and 1,103 feet south of the northeast corner of sec. 6, T. 12 N., R. 14 E.

A1—0 to 3 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine roots; medium acid; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; many fine roots; medium acid; abrupt wavy boundary.

E—6 to 12 inches; pale brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable; many fine roots; slightly acid; abrupt wavy boundary.

Bt—12 to 19 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse columnar structure; very hard, friable; common fine roots; mildly alkaline; abrupt wavy boundary.

Btk—19 to 23 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to weak coarse subangular blocky; very hard, friable; common fine roots; common medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

BCkz—23 to 32 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure; hard, friable; few fine roots; common fine accumulations of gypsum and other salts; common very fine and fine accumulations of carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—32 to 60 inches; light brownish gray (2.5Y 6/2) soft sandstone, dark grayish brown (2.5Y 4/2) moist; violent effervescence; strongly alkaline.

The thickness of the solum ranges from 17 to 33 inches. The depth to free carbonates ranges from 13 to 22 inches.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is loamy fine sand. It is 3 to 6 inches thick. The E horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is fine sandy loam or loamy fine sand. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is loam, sandy clay loam, or clay loam. The BCk horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is fine sandy loam, sandy loam, sandy clay loam, or loam. The Cr horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8 (4 to 7 moist), and chroma of 1 to 4. It typically is soft sandstone but has interbedded siltstone or clayey shale in some pedons. Some layers in this horizon do not have free carbonates.

Pierre Series

The Pierre series consists of moderately deep, well drained soils formed in clayey residuum on uplands. When dry, these soils are characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 2 to 30 percent.

Pierre soils are similar to Abor, Kyle, and Lawther soils and commonly are near Kyle, Lismas, Samsil, and Stetter soils. Abor soils contain less clay throughout than the Pierre soils. Kyle, Lawther, and Stetter soils are more than 40 inches deep to shale. Lismas and Samsil soils are on the steeper, more convex parts of the landscape. They are 10 to 20 inches deep over shale. The stratified Stetter soils are on flood plains.

Typical pedon of Pierre clay, 2 to 6 percent slopes, 2,600 feet south and 200 feet west of the northeast corner of sec. 29, T. 9 N., R. 10 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium granular structure parting to weak very fine granular; slightly hard, firm, sticky and plastic; many roots; neutral; clear smooth boundary.

Bw—3 to 15 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm, sticky and plastic; common roots; strong effervescence; mildly alkaline; gradual wavy boundary.

Ck—15 to 24 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm, sticky and plastic; few roots; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cky—24 to 28 inches; olive gray (5Y 5/2) shaly clay, olive gray (5Y 4/2) moist; massive; hard, firm, sticky and plastic; very few roots; few fine accumulations of carbonate, gypsum, and other salts; slight effervescence; mildly alkaline; clear wavy boundary.

Cr—28 to 60 inches; gray (5Y 6/1) shale, dark gray (5Y 4/1) moist; common distinct dark yellowish brown stains; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 15 to 31 inches. The depth to shale ranges from 20 to 40 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is 2 to 5 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is clay or shaly clay. The Cr horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 4.

Samsil Series

The Samsil series consists of shallow, well drained soils formed in clayey residuum on uplands. Permeability is slow. Slopes range from 6 to 40 percent.

Samsil soils are similar to Lismas and Yawdim soils and commonly are near Kyle, Lohmiller, and Pierre soils. Kyle soils are more than 40 inches deep to shale. They generally are on the lower side slopes. Lismas soils do not have free carbonates. The stratified Lohmiller soils are on flood plains. Pierre soils are 20 to 40 inches deep over clayey shale. They are slightly lower on the landscape than the Samsil soils. Yawdim soils contain less clay throughout than the Samsil soils.

Typical pedon of Samsil clay, 6 to 25 percent slopes, 7 feet south and 7 feet east of the northwest corner of sec. 9, T. 6 N., R. 15 E.

A—0 to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very fine and fine granular structure; slightly hard, very friable; many roots; few fine shale chips; violent effervescence; mildly alkaline; abrupt wavy boundary.

AC—2 to 7 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist, dark grayish brown (2.5Y 4/2) crushed and moist; weak fine and medium subangular blocky structure; hard, firm; many roots; few fine shale chips; violent effervescence; mildly alkaline; gradual wavy boundary.

C—7 to 13 inches; grayish brown (2.5Y 5/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm; common roots; about 25 percent fine shale fragments; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

Cr—13 to 60 inches; light brownish gray (2.5Y 6/2) shale, dark grayish brown (2.5Y 4/2) moist; few iron and manganese stains along bedding planes; few fine roots in the upper 12 inches; slight effervescence; neutral.

The depth to shale ranges from 6 to 20 inches. Reaction is neutral to moderately alkaline throughout the profile. Shale chips are few or common in all horizons.

The A horizon has hue of 5Y, 2.5Y, or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It dominantly is clay but in some pedons is silty clay. It is 2 to 4 inches thick. The C horizon has hue of 5Y, 2.5Y, or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 4. It is clay or shaly clay. The Cr horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. It has gypsum crystals throughout the upper part.

Satanta Series

The Satanta series consists of deep, well drained soils formed in loamy alluvium on terraces. Permeability is moderate. Slopes range from 0 to 6 percent.

Satanta soils are similar to Assinniboine, Attewan, Eapa, and Marmarth soils and commonly are near Attewan and Nunn soils. All of these soils, except for Nunn soils, are in the cooler parts of the survey area. Assinniboine soils contain more sand throughout than the Satanta soils. Attewan soils, are 20 to 40 inches deep to gravelly material. Marmarth soils are 20 to 40 inches deep over soft sandstone. Nunn soils contain more clay throughout than the Satanta soils. They are in positions on the landscape similar to those of the Satanta soils.

Typical pedon of Satanta loam, 2 to 6 percent slopes, 825 feet west and 2,600 feet south of the northeast corner of sec. 4, T. 6 N., R. 16 E.

A1—0 inches to 1 inch; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak thin and medium platy structure parting to weak fine and medium granular; slightly hard, very friable; many roots; slightly acid; abrupt smooth boundary.

A2—1 to 6 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium granular structure parting to weak fine granular; hard, very friable, slightly sticky and slightly plastic; many roots; slightly acid; clear smooth boundary.

Bt1—6 to 10 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak coarse and medium prismatic structure parting to moderate coarse and medium blocky; hard, friable, sticky and plastic; shiny surfaces on faces of peds; common fine roots; neutral; clear wavy boundary.

Bt2—10 to 16 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; moderate coarse and medium prismatic structure; hard, friable, sticky and plastic; shiny surfaces on faces of peds; common roots; neutral; abrupt wavy boundary.

Bk—16 to 21 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky; few roots; violent effervescence; mildly alkaline; gradual wavy boundary.

C1—21 to 37 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and plastic; few roots; common medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—37 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few medium accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 15 to 36 inches. The thickness of the mollic epipedon ranges from 8 to 14 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It dominantly is loam but in some pedons is clay loam. It is 5 to 8 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It is loam, sandy clay loam, or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly clay loam or loam, but in some pedons it has thin layers of fine sandy loam or sandy clay loam.

Savo Series

The Savo series consists of deep, well drained soils formed in silty and clayey material on high terraces. Permeability is moderately slow. Slopes range from 2 to 9 percent.

Savo soils are similar to Nunn and Tanna soils and commonly are near Assinniboine, Delridge, and Tanna soils. Assinniboine soils contain more sand and less clay throughout than the Savo soils. They are in positions on the landscape similar to those of the Savo soils. Delridge soils do not have a mollic epipedon. They are higher on the landscape than the Savo soils. Nunn soils contain more sand throughout than the Savo soils. Tanna soils are 20 to 40 inches deep over soft bedrock.

Typical pedon of Savo silt loam, in an area of Tanna-Savo complex, 2 to 6 percent slopes, 1,905 feet south and 1,570 feet west of the northeast corner of sec. 36, T. 8 N., R. 15 E.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable; many roots; slightly acid; clear smooth boundary.

Bt1—4 to 8 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; very hard, firm, sticky and plastic; shiny surfaces on faces of peds; common roots; slightly acid; clear wavy boundary.

Bt2—8 to 18 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist, weak coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm, sticky and plastic; shiny surfaces on faces of peds; common roots; neutral; abrupt wavy boundary.

Bk—18 to 30 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable, slightly sticky and plastic; few roots; strong effervescence; mildly alkaline; gradual wavy boundary.

C—30 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 15 to 20 inches. The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2. It dominantly is silt loam but in some pedons is silty clay loam. It is 4 to 8 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is silty clay or silty clay loam. The content of clay in this horizon ranges from 35 to 50 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (5 or 6 moist), and chroma of 2 or 3. It is silt loam, loam, or silty clay loam. In some pedons gravelly material is below a depth of 40 inches.

Stetter Series

The Stetter series consists of deep, well drained soils formed in clayey alluvium on flood plains. Permeability is slow or very slow. Slopes range from 0 to 2 percent.

Stetter soils are similar to Lohmiller soils and commonly are near Hisle, Kyle, Lohmiller, and Swanboy soils. Hisle, Kyle, and Swanboy soils are higher on the landscape than the Stetter soils. Hisle soils have a natric horizon. Kyle and Swanboy soils are not stratified and contain more clay throughout than the Stetter soils. Lohmiller soils contain less clay throughout than the Stetter soils.

Typical pedon of Stetter clay, 660 feet north and 1,600 feet east of the southwest corner of sec. 8, T. 8 N., R. 10 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak thin and medium platy structure parting to weak fine granular; hard, firm, sticky and plastic; cracks 0.5 inch to 2 inches wide when dry; many roots; neutral; abrupt smooth boundary.

C1—3 to 17 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; cracks 0.5 to 1 inch wide when dry; thin strata of light gray silty clay; many roots; neutral; gradual wavy boundary.

C2—17 to 32 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few cracks 0.25 to 0.75 inch wide when dry; common roots; neutral; gradual wavy boundary.

C3—32 to 37 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; massive; very hard, firm, sticky and plastic; thin strata of light gray clay; few roots; neutral; gradual wavy boundary.

Cy—37 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; thin strata of light gray clay; many fine accumulations of gypsum; mildly alkaline.

The A horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay. The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2. It is dominantly silty clay or clay. In some pedons, however, it has thin strata of loamy or sandy alluvium below a depth of 40 inches.

Swanboy Series

The Swanboy series consists of deep, well drained soils formed in clayey material on foot slopes. When dry, these soils are characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 0 to 2 percent.

Swanboy soils are similar to Winler soils and commonly are near Kyle, Pierre, and Winler soils. Kyle soils do not have visible salts within a depth of 15 inches. They are in positions on the landscape similar to those of the Swanboy soils. Pierre and Winler soils are 20 to 40 inches deep over shale. Pierre soils are on side slopes above the Swanboy soils.

Typical pedon of Swanboy clay, 1,320 feet south and 970 feet east of the northwest corner of sec. 18, T. 8 N., R. 10 E.

A—0 to 2 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak thin platy structure parting to weak fine and medium subangular blocky; hard, firm, sticky and plastic; cracks 0.5 inch to 2 inches wide when dry; many roots; neutral; abrupt smooth boundary.

Bw—2 to 10 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm, sticky and very plastic; cracks 0.5 to 1 inch wide when dry; common roots; neutral; gradual wavy boundary.

Bz—10 to 22 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; weak medium subangular blocky structure; very hard, firm, sticky and very plastic; few roots; cracks 0.5 to 1 inch wide when dry; few fine accumulations of gypsum and other salts; neutral; gradual wavy boundary.

Cz—22 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; very hard, firm, sticky and very plastic; common fine accumulations of gypsum and other salts; mildly alkaline.

These soils generally do not have free carbonates, but in some pedons they are calcareous at the surface. The A horizon has hue of 2.5Y or 5Y, value of 6 or 7 (4 or 5 moist), and chroma of 1 or 2. The Bw horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It has few or common accumulations of salt crystals. In some pedons silt loam or silty clay loam is below a depth of 40 inches.

Tanna Series

The Tanna series consists of moderately deep, well drained soils formed in silty and clayey residuum on uplands. Permeability is slow. Slopes range from 0 to 9 percent.

Tanna soils are similar to Nunn and Savo soils and commonly are near Abor, Delridge, and Savo soils. Abor soils contain more clay in the subsoil than the Tanna soils. They are in positions on the landscape similar to those of the Tanna soils. Delridge soils contain less clay in the subsoil than the Tanna soils. They are on convex slopes on the higher parts of the landscape. Nunn and Savo soils are more than 40 inches deep to soft bedrock.

Typical pedon of Tanna silty clay loam, in an area of Tanna-Savo complex, 2 to 6 percent slopes, 200 feet east and 200 feet north of the southwest corner of sec. 26, T. 8 N., R. 15 E.

Ap—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine and medium granular structure; slightly hard, friable; common fine roots; neutral; abrupt smooth boundary.

Bt1—5 to 12 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse blocky; hard, firm, sticky and plastic; shiny surfaces on faces of peds; neutral; clear wavy boundary.

Bt2—12 to 17 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm, slightly sticky and slightly plastic; shiny surfaces on faces of peds; neutral; abrupt wavy boundary.

Bk1—17 to 24 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm, slightly sticky and slightly plastic; shiny surfaces on faces of peds; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Bk2—24 to 27 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; very hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; few fine roots; violent effervescence; mildly alkaline; clear wavy boundary.

Ck—27 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—32 to 60 inches; light brownish gray (2.5Y 6/2) soft shale, grayish brown (2.5Y 5/2) moist; violent effervescence; moderately alkaline.

The depth to free carbonates ranges from 11 to 18 inches. The depth to soft bedrock ranges from 20 to 40 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 2. It dominantly is silty clay loam but in some pedons is silty clay. It is 5 to 7 inches thick. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is silty clay loam or silty clay. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silty clay loam or clay.

Twilight Series

The Twilight series consists of moderately deep, well drained soils formed in material weathered from soft sandstone. These soils are on uplands. Permeability is moderately rapid. Slopes range from 4 to 15 percent.

Twilight soils are similar to Assinniboine soils and commonly are near Assinniboine, Blackhall, Bullock, and Eapa soils. Assinniboine soils are more than 40 inches deep over soft bedrock. Blackhall soils are 10 to 20 inches deep over soft bedrock. They are on ridges and the upper side slopes. Bullock soils have a natric horizon. They are in small pits and depressions. Eapa soils contain more clay in the subsoil than the Twilight soils. They are in positions on the landscape similar to those of the Twilight soils.

Typical pedon of Twilight fine sandy loam, in a area of Blackhall-Twilight fine sandy loams, 9 to 40 percent slopes, 2,000 feet east and 1.900 feet south of the northwest corner of sec. 9, T. 9 N., R. 13 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many roots; neutral; abrupt smooth boundary.

Bw—3 to 10 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common roots; neutral; abrupt wavy boundary.

BC—10 to 18 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, very friable; common roots; slight effervescence; neutral; gradual wavy boundary.

C—18 to 36 inches; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; few roots; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—36 to 60 inches; light gray (2.5Y 7/2) soft sandstone, grayish brown (2.5Y 5/2) moist; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 7 to 20 inches. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It dominantly is fine sandy loam but in some pedons is sandy loam. It is 3 to 6 inches thick. The Bw horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is fine sandy loam or sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It is fine sandy loam or sandy loam. The Cr horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 8 (2 to 7 moist), and chroma of 1 to 4. It typically is soft sandstone, but in some pedons it is interbedded sandstone, soft siltstone, clayey shale, or lignite.

Winler Series

The Winler series consists of moderately deep, well drained soils formed in material weathered from clayey shale. These soils are on uplands. When dry, they are characterized by cracks, which are 0.5 inch to 2 inches wide and several feet long and extend through the subsoil. Permeability is very slow. Slopes range from 2 to 15 percent.

Winler soils are similar to Pierre soils and commonly are near Kyle, Lismas, Pierre, and Swanboy soils. Kyle and Swanboy soils are lower on the landscape than the Winler soils. They are more than 40 inches deep to shale. Lismas soils are 10 to 20 inches deep over shale. They are on the steeper ridges. Pierre soils are calcareous throughout.

Typical pedon of Winler clay, in an area of Winler-Lismas clays, 6 to 15 percent slopes, 330 feet west and 165 feet north of the southeast corner of sec. 7, T. 8 N., R. 10 E.

A—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak thick and medium platy structure parting to weak medium and fine granular; hard, firm, sticky and plastic; cracks 0.5 inch to 2 inches wide when dry; many roots; neutral; abrupt wavy boundary.

Bw—3 to 10 inches; olive (5Y 5/3) clay, olive (5Y 5/3) moist; moderate coarse prismatic structure parting to moderate coarse and medium subangular blocky; very hard, firm, very sticky and very plastic; cracks 0.5 to 1 inch wide when dry; many roots; neutral; gradual wavy boundary.

Bz—10 to 15 inches; light olive gray (5Y 6/2) clay, olive (5Y 5/3) moist; weak coarse and medium subangular blocky structure; very hard, firm, very sticky and very plastic; few fine prominent yellowish red (5YR 4/8) stains (iron and manganese oxides); cracks 0.5 to 1 inch wide when dry; common roots; many fine accumulations of gypsum and other salts; neutral; abrupt wavy boundary.

C—15 to 23 inches; light olive gray (5Y 6/2) clay, olive (5Y 5/3) moist; massive; very hard, firm, sticky and plastic; fine prominent yellowish red (5YR 4/8) stains (iron and manganese oxides); few cracks 0.5

to 0.75 inch wide when dry; common fragments of shale; common roots; slight effervescence; mildly alkaline; gradual wavy boundary.

Cr—23 to 60 inches; light olive gray (5Y 6/2) shale, olive gray (5Y 4/2) moist; yellowish red and yellowish brown stains on bedding planes of the shale; slight effervescence; mildly alkaline.

The depth to bedrock ranges from 20 to 40 inches. The depth to visible salts ranges from about 8 to 17 inches. In some pedons free carbonates are in the lower part of the solum and in the underlying material.

The A horizon has hue of 2.5Y or 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It dominantly is clay but in some pedons is silty clay. It is 2 to 5 inches thick. The Bw horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is clay or shaly clay. The Cr horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3.

Yawdim Series

The Yawdim series consists of shallow, well drained soils formed in material weathered from siltstone and shale. These soils are on uplands. Permeability is slow. Slopes range from 6 to 9 percent.

Yawdim soils are similar to Lismas and Samsil soils and commonly are near Abor and Lawther soils. Abor and Lawther soils are lower on the landscape than the Yawdim soils. Abor soils are 20 to 40 inches deep over soft bedrock. Lawther soils are more than 40 inches deep over soft bedrock. Lismas and Samsil soils contain more clay throughout than the Yawdim soils.

Typical pedon of Yawdim silty clay loam, 6 to 9 percent slopes, 1,370 feet west and 1,940 feet south of the northeast corner of sec. 25, T. 10 N., R. 11 E.

A—0 to 2 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak very fine granular structure; slightly hard, firm, sticky and plastic; common roots; slight effervescence; mildly alkaline; clear wavy boundary.

C—2 to 14 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; very hard, firm, sticky and plastic; common roots; slight effervescence; moderately alkaline; clear wavy boundary.

Cy—14 to 19 inches; gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; few fine distinct iron stains, olive yellow (2.5Y 6/6) and light olive brown (2.5Y 5/6) moist; massive; hard, firm, sticky and plastic; common roots; many fine gypsum crystals; slight effervescence; moderately alkaline; gradual wavy boundary.

Cr—19 to 60 inches; light gray (5Y 6/1) shale, gray (5Y 5/1) moist; common medium and coarse distinct yellowish brown (10YR 5/6) stains, dark yellowish brown (10YR 4/6) moist (iron and manganese oxides); few fine gypsum crystals; slight effervescence; moderately alkaline.

The depth to bedrock ranges from 10 to 20 inches. Free carbonates typically are throughout the profile, but in some pedons they are not evident in the surface layer.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2. It dominantly is silty clay loam but in some pedons is silty clay. It is 1 to 5 inches thick. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 or 2. It is silty clay loam or silty clay. The Cr horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It typically is soft, clayey shale, but it has layers of soft sandstone or siltstone in some pedons.

Formation of the Soils

Soil forms when chemical and physical processes act on geologically deposited or accumulated material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are modified by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in the survey area.

Climate

Climate directly influences the rate of chemical and physical weathering. The survey area has a continental climate marked by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. The climate in the northern part of the survey area is somewhat cooler than that in the southern part. Thus, it is a factor in differentiating some of the soils within the survey area. Additional climatic data are given under the heading "General Nature of the Survey Area."

Plant and Animal Life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In this survey area the tall and mid prairie grasses have had more influence than other living organisms on soil formation. As a result of these grasses, the surface layer of many of the soils has a moderate or high content of organic matter. Grail soils are an example.

Earthworms, insects, and burrowing animals help to keep the soils open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

Parent Material

Parent material is the unconsolidated organic and mineral material in which soil forms. It determines many of the chemical and physical characteristics of the soil, such as color, texture, reaction, and consistence. The rate of soil formation is more rapid in the more friable, loamy and silty parent material than in other kinds of parent material. Also, more changes take place, and the horizons are more distinct.

Most of the soils in the survey area formed in material weathered from the underlying bedrock. The remainder formed in old alluvial deposits on high terraces and recent alluvial deposits on flood plains, in swales, and in depressions on uplands.

The bedrock in the northern part of the survey area dominantly consists of strata of weakly cemented, fine grained, calcareous sandstone and siltstone of the Fox Hills and Hell Creek Formations. The shallow Cabbart and Blackhall and moderately deep Delridge, Marmarth, and Twilight soils are examples of soils that formed in material weathered from these formations. The sodium affected Bullock and Parchin soils also are examples. Soils that formed in material weathered from Pierre Shale are mainly in the southwestern part of the survey area and on the breaks along the Cheyenne River. The Pierre Shale is dark gray to light gray and has beds of bentonite and seams of limestone, iron, and manganese concretions. Lismas, Pierre, and Winler are examples of soils that formed in material weathered from the Pierre Formation.

The alluvium in the survey area is recent deposits of sandy to clayey material on flood plains and older deposits of loamy and silty material on high terraces. Bankard, Havre, and Stetter are examples of soils that formed in alluvium on flood plains. Nunn, Savo, and Satanta are examples of soils that formed in old alluvium on high terraces. Grail and Heil are examples of soils that formed partly or entirely in local alluvium washed in from the more sloping adjacent soils in the uplands. Attewan and Nihill are examples of soils that formed in alluvium on terraces and terrace scarps. They are loamy and are underlain by sand and gravel.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the more sloping soils, such as Delridge soils, much of the rainfall is lost through runoff and thus does not penetrate the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and are calcareous at or near the surface. Runoff is slower on Assinniboine, Eapa, Nunn, Satanta, and other less sloping soils, and more water penetrates the surface. These soils are calcareous at a greater depth than the Delridge soils. Also, the horizons in which organic matter accumulates are thicker.

The Grail soils in swales and on flats receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter accumulates are thicker than those in the slightly higher adjacent Eapa soils. In low areas where drainage is impeded, the fluctuating water table favors the concentration of salts in some soils, such as Lardell. Heil soils are in depressions where water ponds. They have the colors characteristic of poorly drained soils.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that have formed. The degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable for the longest time. In this survey area they are the Eapa and Nunn soils. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Cabbart and Samsil soils are examples of young soils that are subject to natural erosion, and Havre soils are an example of young alluvial soils.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour farming. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed native range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are—

	Inches
Deep	more than 40
Moderately deep	20 to 40
Shallow	less than 20

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species that respond to continued overgrazing, at least initially, by increasing in amount in relation to other plants in the community.

Invaders. On range, plants that were not part of the original plant community and that encroach into an area and grow after the native vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting. Making shallow pits of suitable capacity and distribution to retain water from rainfall or snowmelt on rangeland or pasture.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Potential native vegetation. The stabilized plant community on a particular range site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

	Percent
Level	0 to 1
Nearly level	0 to 2 or 0 to 3
Gently sloping	2 to 6
Moderately sloping	6 to 9
Strongly sloping	9 to 15
Moderately steep	15 to 25
Steep	25 to 40

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data were recorded in the period 1951-79 at Faith, South Dakota]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	25.3	4.0	14.7	55	-29	20	0.34	0.11	0.53	2	4.4
February---	31.5	10.4	21.0	62	-22	29	.60	.15	.95	2	7.2
March------	40.4	18.8	29.6	76	-13	67	.77	.23	1.21	2	7.0
April------	56.7	32.1	44.4	85	11	188	1.68	.45	2.67	4	4.9
May--------	69.6	43.7	56.7	91	25	518	2.78	1.24	4.08	6	.6
June-------	78.9	52.7	65.8	101	37	774	3.37	1.78	4.76	7	.1
July-------	87.7	58.4	73.1	105	46	1,026	2.12	.69	3.28	4	.0
August-----	86.8	56.8	71.8	104	41	986	1.68	.66	2.53	4	.0
September--	75.7	46.2	61.0	100	25	630	1.10	.18	1.81	3	.0
October----	63.3	35.8	49.6	88	16	317	.80	.14	1.32	2	.5
November---	43.3	21.0	32.2	71	- 6	40	.44	.06	.72	2	4.3
December---	31.7	11.1	21.4	62	-24	35	.38	.12	.59	2	5.0
Yearly:											
Average--	57.6	32.6	45.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	-28	---	---	---	---	---	---
Total----	---	---	---	---	---	4,630	16.06	13.27	18.98	40	34.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-79 at Faith, South Dakota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 6	May 13	May 29
2 years in 10 later than--	May 1	May 8	May 23
5 years in 10 later than--	April 20	April 28	May 12
First freezing temperature in fall:			
1 year in 10 earlier than--	September 29	September 22	September 9
2 years in 10 earlier than--	October 4	September 27	September 14
5 years in 10 earlier than--	October 15	October 6	September 23

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-79 at Faith, South Dakota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	154	140	115
8 years in 10	162	147	122
5 years in 10	177	160	133
2 years in 10	192	174	145
1 year in 10	200	181	151

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
		19,290	1.8
AbB	Abor silty clay, 2 to 6 percent slopes	6,655	0.6
AbC	Abor silty clay, 6 to 9 percent slopes	25,620	2.4
AlB	Absher-Slickspots complex, 2 to 6 percent slopes	37,035	3.4
AsB	Assinniboine fine sandy loam, 2 to 6 percent slopes	5,085	0.5
AsC	Assinniboine fine sandy loam, 6 to 9 percent slopes	31,160	2.9
AtC	Assinniboine-Twilight fine sandy loams, 6 to 9 percent slopes	825	0.1
Ba	Bankard loamy fine sand	795	0.1
Bb	Bankard gravelly loamy sand	19,930	1.9
BlE	Blackhall-Rock outcrop complex, 15 to 40 percent slopes	43,930	4.1
BmE	Blackhall-Twilight fine sandy loams, 9 to 40 percent slopes	9,920	0.9
BoE	Bullock-Lardell-Blackhall complex, 2 to 40 percent slopes	90,755	8.4
BpB	Bullock-Parchin fine sandy loams, 0 to 4 percent slopes	14,255	1.3
BsB	Bullock-Slickspots complex, 0 to 4 percent slopes	61,935	5.8
CaD	Cabbart loam, 9 to 40 percent slopes	425	*
CvB	Cabbart Variant loam, 2 to 6 percent slopes	80,965	7.5
DeC	Delridge-Cabbart loams, 6 to 15 percent slopes	3,545	0.3
EaA	Eapa loam, 0 to 2 percent slopes	21,095	2.0
EaB	Eapa loam, 2 to 6 percent slopes	2,150	0.2
EaC	Eapa loam, 6 to 9 percent slopes	21,685	2.0
EdB	Eapa-Delridge loams, 2 to 6 percent slopes	11,810	1.1
EdC	Eapa-Delridge loams, 6 to 9 percent slopes	30,265	2.8
EgB	Eapa-Grail complex, 2 to 6 percent slopes	15,070	1.4
EgC	Eapa-Grail complex, 6 to 9 percent slopes	67,170	6.2
GaA	Gerdrum loam, 0 to 4 percent slopes	2,550	0.2
Gc	Glenberg fine sandy loam	2,165	0.2
Gr	Grail silt loam	11,605	1.1
Hb	Havre loam	28,595	2.7
Hc	Havre loam, channeled	1,890	0.2
He	Heil silty clay loam	4,415	0.4
HfB	Hisle-Slickspots complex, 0 to 4 percent slopes	3,240	0.3
KyA	Kyle clay, 0 to 2 percent slopes	11,955	1.1
KyB	Kyle clay, 2 to 6 percent slopes	8,580	0.8
La	Lardell fine sandy loam	31,895	3.0
LaB	Lawther silty clay, 2 to 6 percent slopes	4,360	0.4
LbE	Lismas clay, 15 to 40 percent slopes	15,305	1.4
LcA	Loburn-Gerdrum complex, 0 to 3 percent slopes	6,370	0.6
Ld	Lohmiller silty clay loam	10,830	1.0
Lg	Lohmiller silty clay loam, channeled	5,935	0.6
NaD	Nihill-Attewan complex, 4 to 20 percent slopes	1,700	0.2
NuA	Nunn clay loam, 0 to 2 percent slopes	8,515	0.8
NuB	Nunn clay loam, 2 to 6 percent slopes	42,735	4.0
PbB	Parchin-Bullock fine sandy loams, 2 to 6 percent slopes	12,740	1.2
PeB	Pierre clay, 2 to 6 percent slopes	5,675	0.5
PeC	Pierre clay, 6 to 15 percent slopes	5,010	0.5
PlE	Pierre-Lismas clays, 15 to 40 percent slopes	12,325	1.1
PsC	Pierre-Samsil clays, 6 to 15 percent slopes	5,160	0.5
RoE	Rock outcrop-Cabbart-Bullock complex, 15 to 40 percent slopes	30,670	2.9
SaD	Samsil clay, 6 to 25 percent slopes	25,930	2.4
SbE	Samsil-Rock outcrop complex, 15 to 40 percent slopes	2,130	0.2
SdA	Satanta loam, 0 to 2 percent slopes	4,195	0.4
SdB	Satanta loam, 2 to 6 percent slopes	3,790	0.4
St	Stetter clay	5,660	0.5
SwA	Swanboy clay	3,140	0.3
SyA	Swanboy-Slickspots complex, 0 to 2 percent slopes	17,075	1.6
TdB	Tanna-Delridge complex, 2 to 6 percent slopes	5,185	0.5
TdC	Tanna-Delridge complex, 6 to 9 percent slopes	31,690	2.9
TsB	Tanna-Savo complex, 2 to 6 percent slopes	4,205	0.4
TsC	Tanna-Savo complex, 6 to 9 percent slopes	61,540	5.7
TwC	Twilight-Harmarth-Parchin fine sandy loams, 4 to 9 percent slopes	3,115	0.3
WhC	Winler clay, 2 to 9 percent slopes	4,645	0.4
WlC	Winler-Lismas clays, 6 to 15 percent slopes	3,760	0.3
YaC	Yawdim silty clay loam, 6 to 9 percent slopes	3,747	0.3
	Water areas less than 40 acres		
	Total	1,075,397	100.0

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* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Winter wheat*	Oats	Grain sorghum	Alfalfa hay	Cool-season grass
		Bu	Bu	Bu	Tons	AUM**
AbB Abor	IVe-3	26	34	27	1.2	2.0
AbC Abor	IVe-14	20	26	21	0.6	1.0
AlB:		---	---	---	---	---
Absher	VIs-3					
Slickspots	VIIIs-3					
AsB Assinniboine	IVe-6	30	38	32	1.4	2.3
AsC Assinniboine	IVe-7	26	33	28	0.9	1.5
AtC Assinniboine-Twilight	IVe-7	20	26	22	0.5	0.9
Ba Bankard	VIe-8	---	---	---	---	---
Bb Bankard	VIw-3	---	---	---	---	---
BlE:		---	---	---	---	---
Blackhall	VIIe-3					
Rock outcrop	VIIIs-1					
BmE:		---	---	---	---	---
Blackhall	VIIe-3					
Twilight	VIe-7					
BoE:		---	---	---	---	---
Bullock	VIs-3					
Lardell	VIw-3					
Blackhall	VIIe-3					
BpB Bullock-Parchin	VIs-3	---	---	---	---	---
BsB:		---	---	---	---	---
Bullock	VIs-3					
Slickspots	VIIIs-3					
CaD Cabbart	VIe-2	---	---	---	---	---
CvB Cabbart Variant	VIs-1	---	---	---	---	---
DeC Delridge-Cabbart	VIe-3	---	---	---	---	---
EaA Eapa	IIIc-1	34	41	36	1.6	2.7
EaB Eapa	IIIe-1	32	39	35	1.5	2.5
EaC Eapa	IVe-1	29	35	29	1.3	2.2
EdB:		22	29	23	0.7	1.2
Eapa	IIIe-1					
Delridge	IVe-8					

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Winter wheat*	Oats	Grain sorghum	Alfalfa hay	Cool-season grass
		Bu	Bu	Bu	Tons	AUM**
EdC-------------------------		21	27	20	0.5	1.0
Eapa------------------------	IVe-1					
Delridge--------------------	IVe-8					
EgB-------------------------		37	46	40	1.9	3.2
Eapa------------------------	IIIe-1					
Grail-----------------------	IIe-3					
EgC-------------------------		30	37	30	1.3	2.2
Eapa------------------------	IVe-1					
Grail-----------------------	IIIe-1					
GaA------------------------- Gerdrum	IVs-3	15	21	15	0.5	0.9
Gc-------------------------- Glenberg	IIIe-4	22	32	24	1.8	3.0
Gr-------------------------- Grail	IIc-3	40	47	41	2.2	3.7
Hb-------------------------- Havre	IIIc-2	33	43	34	2.0	3.3
Hc-------------------------- Havre	VIw-1	---	---	---	---	---
He-------------------------- Heil	VIs-3	---	---	---	---	---
HfB-------------------------		---	---	---	---	---
Hisle-----------------------	VIs-3					
Slickspots------------------	VIIIs-3					
KyA------------------------- Kyle	IVs-3	26	32	27	1.1	1.8
KyB------------------------- Kyle	IVe-3	24	31	24	0.9	1.5
La-------------------------- Lardell	VIw-3	---	---	---	---	---
LaB------------------------- Lawther	IVe-3	28	35	28	1.4	2.3
LbE------------------------- Lismas	VIIe-5	---	---	---	---	---
LcA-------------------------		14	19	14	0.4	0.5
Loburn----------------------	IVs-2					
Gerdrum---------------------	IVs-3					
Ld-------------------------- Lohmiller	IIIc-2	33	42	36	2.0	3.3
Lg-------------------------- Lohmiller	VIw-1	---	---	---	---	---
NaD------------------------- Nihill-Attewan	VIs-4	---	---	---	---	---
NuA------------------------- Nunn	IIIc-1	34	41	35	1.6	2.7
NuB------------------------- Nunn	IIIe-1	32	39	32	1.4	2.3
PbB-------------------------		14	20	15	0.3	0.5
Parchin---------------------	IVe-12					
Bullock---------------------	VIs-3					

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Winter wheat*	Oats	Grain sorghum	Alfalfa hay	Cool-season grass
		Bu	Bu	Bu	Tons	AUM**
PeB Pierre	IVe-3	23	30	21	0.7	1.2
PeC Pierre	VIe-4	---	---	---	---	---
PlE		---	---	---	---	---
Pierre	VIe-4					
Lismas	VIIe-5					
PsC		---	---	---	---	---
Pierre	VIe-4					
Samsil	VIe-12					
RoE		---	---	---	---	---
Rock outcrop	VIIIs-1					
Cabbart	VIIe-4					
Bullock	VIIe-7					
SaD Samsil	VIe-12	---	---	---	---	---
SbE		---	---	---	---	---
Samsil	VIIe-5					
Rock outcrop	VIIIs-1					
SdA Satanta	IIIc-1	34	42	37	1.6	2.7
SdB Satanta	IIIe-1	33	40	35	1.5	2.5
St Stetter	IVs-3	17	25	17	1.6	2.7
SwA Swanboy	VIs-6	---	---	---	---	---
SyA		---	---	---	---	---
Swanboy	VIs-6					
Slickspots	VIIIs-3					
TdB		20	27	21	0.6	1.0
Tanna	IIIe-1					
Delridge	IVe-3					
TdC Tanna-Delridge	IVe-1	18	24	17	0.5	0.9
TsB Tanna-Savo	IIIe-1	29	36	29	1.4	2.3
TsC Tanna-Savo	IVe-1	25	31	24	0.8	1.3
TwC		17	23	18	0.7	1.2
Twilight	IVe-7					
Marmarth	IVe-1					
Parchin	IVe-12					
WhC Winler	VIs-6	---	---	---	---	---
WlC		---	---	---	---	---
Winler	VIs-6					
Lismas	VIe-12					
YaC Yawdim	VIe-12	---	---	---	---	---

* Winter wheat is grown in a summer fallow system of management, and the predicted yield can be expected only in alternate years.

** Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
AbB, AbC Abor	Clayey	1,900	1,600	1,100
AlB*: Absher	Thin Claypan	1,000	800	600
Slickspots.				
AsB, AsC Assinniboine	Sandy	2,500	2,100	1,500
AtC*: Assinniboine	Sandy	2,500	2,100	1,500
Twilight	Sandy	2,300	1,900	1,300
Ba Bankard	Sands	2,400	2,000	1,400
Bb Bankard	Sands	750	600	500
BlE*: Blackhall	Shallow	1,700	1,400	1,000
Rock outcrop.				
BmE*: Blackhall	Shallow	1,700	1,400	1,000
Twilight	Sandy	2,300	1,900	1,300
BoE*: Bullock	Thin Claypan	1,000	800	600
Lardell	Saline Lowland	2,500	1,700	1,200
Blackhall	Shallow	1,700	1,400	1,000
BpB*: Bullock	Thin Claypan	1,000	800	600
Parchin	Claypan	1,500	1,300	900
BsB*: Bullock	Thin Claypan	1,000	800	600
Slickspots.				
CaD Cabbart	Shallow	1,600	1,300	900
CvB Cabbart Variant	Shallow	1,700	1,400	1,000
DeC*: Delridge	Thin Upland	1,700	1,400	1,000
Cabbart	Shallow	1,600	1,300	900
EaA, EaB, EaC Eapa	Silty	2,300	1,900	1,300
EdB*: Eapa	Silty	2,300	1,900	1,300

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
EdB*: Delridge	Thin Upland	1,700	1,400	1,000
EdC*: Eapa	Silty	2,300	1,900	1,300
Delridge	Thin Upland	1,700	1,400	1,000
EgB*, EgC*: Eapa	Silty	2,300	1,900	1,300
Grail	Silty	2,400	2,000	1,400
GaA Gerdrum	Claypan	1,700	1,400	1,000
Gc Glenberg	Loamy Overflow	3,000	2,500	1,750
Gr Grail	Loamy Overflow	3,500	2,900	2,000
Hb Havre	Loamy Overflow	3,000	2,500	1,750
Hc Havre	Loamy Overflow	3,300	2,800	2,000
He Heil	Closed Depression	2,400	2,200	1,600
HfB*: Hisle	Thin Claypan	900	700	500
Slickspots.				
KyA, KyB Kyle	Clayey	2,000	1,700	1,200
La Lardell	Saline Lowland	800	700	600
LaB Lawther	Clayey	2,200	1,800	1,300
LbE Lismas	Shallow Dense Clay	1,000	800	500
LcA*: Loburn	Claypan	1,700	1,400	1,000
Gerdrum	Claypan	1,700	1,400	1,000
Ld Lohmiller	Loamy Terrace	2,600	2,200	1,500
Lg Lohmiller	Loamy Overflow	3,000	2,500	1,700
NaD*: Nihill	Thin Upland	1,400	1,200	800
Attewan	Silty	1,900	1,600	1,100
NuA Nunn	Clayey	2,200	1,800	1,300

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
NuB Nunn	Clayey	2,000	1,700	1,200
PbB*: Parchin	Claypan	1,500	1,300	900
Bullock	Thin Claypan	1,000	800	600
PeB, PeC Pierre	Clayey	1,900	1,600	1,100
PlE*: Pierre	Clayey	1,900	1,600	1,100
Lismas	Shallow Dense Clay	1,000	800	500
PsC*: Pierre	Clayey	1,900	1,600	1,100
Samsil	Shallow Clay	1,400	1,200	900
RoE*: Rock outcrop.				
Cabbart	Shallow	1,560	1,300	910
Bullock	Thin Claypan	1,000	800	600
SaD Samsil	Shallow Clay	1,400	1,200	900
SbE*: Samsil	Shallow Clay	1,400	1,200	900
Rock outcrop.				
SdA, SdB Satanta	Silty	2,200	1,800	1,300
St Stetter	Clayey Overflow	3,100	2,600	1,800
SwA Swanboy	Dense Clay	1,500	1,200	700
SyA*: Swanboy	Dense Clay	1,500	1,200	700
Slickspots.				
TdB*: Tanna	Clayey	2,000	1,700	1,200
Delridge	Thin Upland	1,700	1,400	1,000
TdC*: Tanna	Clayey	2,000	1,700	1,200
Delridge	Thin Upland	1,700	1,400	1,000
TsB*, TsC*: Tanna	Clayey	2,000	1,700	1,200
Savo	Silty	2,300	1,900	1,300
TwC*: Twilight	Sandy	2,300	1,900	1,300

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
TwC*:				
Marmarth	Silty	2,200	1,800	1,300
Parchin	Claypan	1,500	1,300	900
WhC Winler	Dense Clay	1,700	1,300	800
WlC*:				
Winler	Dense Clay	1,700	1,300	800
Lismas	Shallow Dense Clay	1,300	1,000	600
YaC Yawdim	Shallow	1,700	1,400	1,100

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
AbB, AbC---------- Abor	Tatarian honeysuckle, lilac, American plum, golden currant, Siberian peashrub.	Green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper, common chokecherry.	Siberian elm------	---
AlB*: Absher.				
Slickspots.				
AsB, AsC---------- Assinniboine	American plum, silver buffaloberry.	Rocky Mountain juniper, Manchurian crabapple, Tatarian honeysuckle, lilac, Siberian peashrub, common chokecherry.	Green ash, ponderosa pine, Russian-olive, Siberian elm.	---
AtC*: Assinniboine-----	American plum, silver buffaloberry.	Rocky Mountain juniper, Manchurian crabapple, Tatarian honeysuckle, lilac, Siberian peashrub, common chokecherry.	Green ash, ponderosa pine, Russian-olive, Siberian elm.	---
Twilight---------	Lilac, Peking cotoneaster.	Rocky Mountain juniper, ponderosa pine, Siberian peashrub, Russian-olive, eastern redcedar.	Green ash, Siberian elm.	---
Ba---------------- Bankard	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---
Bb. Bankard				
BlE*: Blackhall.				
Rock outcrop.				
BmE*: Blackhall.				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
BmE*: Twilight.				
BoE*: Bullock.				
Lardell.				
Blackhall.				
BpB*: Bullock.				
Parchin	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle, lilac.	Siberian elm, ponderosa pine.	---	---
BsB*: Bullock.				
Slickspots.				
CaD. Cabbart				
CvB. Cabbart Variant				
DeC*: Delridge	Lilac, Peking cotoneaster, Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, skunkbush sumac.	Ponderosa pine, Rocky Mountain juniper, eastern redcedar, green ash, Russian-olive.	Siberian elm	---
Cabbart.				
EaA, EaB, EaC Eapa	---	Manchurian crabapple, Black Hills spruce, eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub, American plum, common chokecherry, lilac.	Siberian elm, green ash, ponderosa pine.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
EdB*, EdC*:				
Eapa	---	Manchurian crabapple, Black Hills spruce, eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub, American plum, common chokecherry, lilac.	Siberian elm, green ash, ponderosa pine.	---
Delridge	Lilac, Peking cotoneaster, Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, skunkbush sumac.	Ponderosa pine, Rocky Mountain juniper, eastern redcedar, green ash, Russian-olive.	Siberian elm	---
EgB*:				
Eapa	---	Manchurian crabapple, Black Hills spruce, eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub, American plum, common chokecherry, lilac.	Siberian elm, green ash, ponderosa pine.	---
Grail	American plum, Tatarian honeysuckle, Peking cotoneaster.	Green ash, blue spruce, Manchurian crabapple, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood.
EgC*:				
Eapa	---	Manchurian crabapple, Black Hills spruce, eastern redcedar, Russian-olive, Tatarian honeysuckle, Siberian peashrub, American plum, common chokecherry, lilac.	Siberian elm, green ash, ponderosa pine.	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
EgC*: Grail	---	Manchurian crabapple, Black Hills spruce, Russian-olive, eastern redcedar, Tatarian honeysuckle, common chokecherry, lilac, Siberian peashrub, American plum.	Green ash, ponderosa pine, Siberian elm.	---
GaA Gerdrum	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Tatarian honeysuckle, lilac, silver buffaloberry, Siberian peashrub.	Siberian elm, ponderosa pine.	---	---
Gc Glenberg	Lilac, American plum.	Tatarian honeysuckle.	Green ash, hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Siberian elm, honeylocust.
Gr Grail	American plum, Peking cotoneaster, Tatarian honeysuckle.	Green ash, blue spruce, Manchurian crabapple, eastern redcedar, common chokecherry, Siberian peashrub.	Golden willow, ponderosa pine.	Plains cottonwood.
Hb Havre	Tatarian honeysuckle, American plum, Peking cotoneaster.	Green ash, blue spruce, eastern redcedar, common chokecherry, Manchurian crabapple, Siberian peashrub.	Golden willow, ponderosa pine.	Cottonwood.
Hc Havre	Tatarian honeysuckle, American plum, Peking cotoneaster.	Green ash, blue spruce, Manchurian crabapple, common chokecherry, eastern redcedar, Siberian peashrub.	Golden willow, ponderosa pine.	Cottonwood.
He. Heil				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35
HfB*:				
Hisle.				
Slickspots.				
KyA, KyB---------- Kyle	Siberian peashrub, American plum, Tatarian honeysuckle, lilac, golden currant.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, eastern redcedar, common chokecherry.	Siberian elm, honeylocust.	---
La. Lardell				
LaB--------------- Lawther	Golden currant, Siberian peashrub, lilac, American plum, Tatarian honeysuckle.	Green ash, ponderosa pine, Rocky Mountain juniper, Russian-olive, common chokecherry, eastern redcedar.	Siberian elm------	---
LbE--------------- Lismas	---	---	---	---
LcA*:				
Loburn-----------	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle, lilac.	Siberian elm, ponderosa pine.	---	---
Gerdrum----------	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Tatarian honeysuckle, lilac, silver buffaloberry, Siberian peashrub.	Siberian elm, ponderosa pine.	---	---
Ld, Lg------------ Lohmiller	American plum, lilac.	Tatarian honeysuckle.	Ponderosa pine, blue spruce, green ash, hackberry, Russian-olive, eastern redcedar.	Honeylocust, Siberian elm.
NaD*:				
Nihill.				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35
NaD*:				
Attewan	---	Russian-olive, eastern redcedar, Siberian peashrub, ponderosa pine, green ash, Rocky Mountain juniper, hackberry.	Siberian elm	---
NuA, NuB Nunn	---	Siberian peashrub, Black Hills spruce, Manchurian crabapple, plum, Russian-olive, eastern redcedar, common chokecherry, Tatarian honeysuckle, lilac.	Siberian elm, honeylocust, green ash, ponderosa pine.	---
PbB*:				
Parchin	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle, lilac.	Siberian elm, ponderosa pine.	---	---
Bullock.				
PeB, PeC Pierre	Siberian peashrub, American plum, Tatarian honeysuckle, lilac, golden currant.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, eastern redcedar, common chokecherry.	Siberian elm	---
PlE*:				
Pierre.				
Lismas	---	---	---	---
PsC*:				
Pierre	Siberian peashrub, American plum, Tatarian honeysuckle, lilac, golden currant.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, eastern redcedar, common chokecherry.	Siberian elm	---
Samsil.				
RoE*:				
Rock outcrop.				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
RoE*: Cabbart.				
Bullock.				
SaD. Samsil				
SbE*: Samsil.				
Rock outcrop.				
SdA, SdB---------- Satanta	---	Black Hills spruce, Russian-olive, common chokecherry, eastern redcedar, Manchurian crabapple, Tatarian honeysuckle, lilac, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, green ash.	---
St---------------- Stetter	Siberian peashrub, Tatarian honeysuckle, American plum, lilac, golden currant.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, eastern redcedar, common chokecherry.	Siberian elm------	---
SwA. Swanboy				
SyA*: Swanboy.				
Slickspots.				
TdB*, TdC*: Tanna-------------	Tatarian honeysuckle, lilac, American plum, Siberian peashrub, silver buffaloberry.	Russian-olive, eastern redcedar, Rocky Mountain juniper, common chokecherry.	Siberian elm, green ash, ponderosa pine.	---
Delridge---------	Lilac, Peking cotoneaster, Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, skunkbush sumac.	Ponderosa pine, Rocky Mountain juniper, eastern redcedar, green ash, Russian-olive.	Siberian elm------	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	<8	8-15	16-25	26-35
TsB*, TsC*:				
Tanna	Tatarian honeysuckle, lilac, American plum, Siberian peashrub, silver buffaloberry.	Russian-olive, eastern redcedar, Rocky Mountain juniper, common chokecherry.	Siberian elm, green ash, ponderosa pine.	---
Savo	---	Manchurian crabapple, Black Hills spruce, common chokecherry, Siberian peashrub, Russian-olive, eastern redcedar, Tatarian honeysuckle, lilac, American plum.	Siberian elm, ponderosa pine, green ash.	---
TwC*:				
Twilight	Lilac, Peking cotoneaster.	Rocky Mountain juniper, ponderosa pine, Siberian peashrub, Russian-olive, eastern redcedar.	Green ash, Siberian elm.	---
Marmarth	Lilac, Peking cotoneaster.	Ponderosa pine, Rocky Mountain juniper, Russian olive, Siberian peashrub, eastern redcedar.	Siberian elm, green ash.	---
Parchin	Green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle, lilac.	Siberian elm, ponderosa pine.	---	---
WhC. Winler				
WlC*: Winler.				
Lismas	---	---	---	---
YaC. Yawdim				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas
AbB, AbC **Abor**	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
AlB*:							
Absher	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Slickspots.							
AsB, AsC **Assinniboine**	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
AtC*:							
Assinniboine	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
Twilight	Poor	Fair	Good	Poor	Very poor	Very poor	Very poor.
Ba **Bankard**	Very poor	Very poor	Fair	Poor	Fair	Very poor	Very poor.
Bb Bankard	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
BlE*:							
Blackhall	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
Rock outcrop.							
BmE*:							
Blackhall	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
Twilight	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor.
BoE*:							
Bullock	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Lardell	Very poor	Very poor	Fair	Poor	Poor	Very poor	Very poor.
Blackhall	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
BpB*:							
Bullock	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Parchin	Poor	Poor	Poor	Poor	Very poor	Very poor	Very poor.
BsB*:							
Bullock	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Slickspots.							
CaD Cabbart	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
CvB **Cabbart Variant**	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
DeC*:							
Delridge	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor.
Cabbart	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
EaA, EaB **Eapa**	Fair	Good	Good	Good	Very poor	Very poor	Very poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas
EaC---------------- Eapa	Poor	Good	Good	Good	Very poor	Very poor	Very poor.
EdB*:							
Eapa---------------	Fair	Good	Good	Good	Very poor	Very poor	Very poor.
Delridge----------	Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor.
EdC*:							
Eapa---------------	Poor	Good	Good	Fair	Very poor	Very poor	Very poor.
Delridge----------	Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor.
EgB*:							
Eapa---------------	Fair	Good	Good	Good	Very poor	Very poor	Very poor.
Grail--------------	Good	Good	Good	Good	Very poor	Very poor	Very poor.
EgC*:							
Eapa---------------	Poor	Good	Good	Good	Very poor	Very poor	Very poor.
Grail--------------	Fair	Good	Good	Good	Very poor	Very poor	Very poor.
GaA---------------- Gerdrum	Poor	Poor	Poor	Poor	Very poor	Very poor	Very poor.
Gc----------------- Glenberg	Fair	Fair	Good	Good	Fair	Very poor	Very poor.
Gr----------------- Grail	Good	Good	Fair	Good	Very poor	Very poor	Very poor.
Hb----------------- Havre	Fair	Good	Fair	Good	Fair	Very poor	Very poor.
Hc----------------- Havre	Poor	Good	Fair	Good	Fair	Very poor	Very poor.
He----------------- Heil	Very poor	Poor	Poor	Poor	Very poor	Poor	Fair.
HfB*:							
Hisle--------------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Slickspots.							
KyA, KyB----------- Kyle	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
La----------------- Lardell	Very poor	Very poor	Fair	Poor	Poor	Very poor	Very poor.
LaB---------------- Lawther	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
LbE---------------- Lismas	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
LcA*:							
Loburn-------------	Poor	Poor	Poor	Poor	Very poor	Very poor	Very poor.
Gerdrum-----------	Poor	Poor	Poor	Poor	Very poor	Very poor	Very poor.
Ld----------------- Lohmiller	Fair	Good	Good	Good	Fair	Very poor	Very poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas
Lg Lohmiller	Very poor	Good	Fair	Good	Good	Very poor	Very poor.
NaD*:							
Nihill	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
Attewan	Poor	Good	Good	Poor	Very poor	Very poor	Very poor.
NuA, NuB Nunn	Fair	Good	Good	Good	Very poor	Very poor	Very poor.
PbB*:							
Parchin	Poor	Poor	Poor	Poor	Very poor	Very poor	Very poor.
Bullock	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
PeB Pierre	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
PeC Pierre	Very poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
PlE*:							
Pierre	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor.
Lismas	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
PsC*:							
Pierre	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor.
Samsil	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
RoE*: Rock outcrop.							
Cabbart	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.
Bullock	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
SaD Samsil	Very poor	Very poor	Fair	Poor	Fair	Very poor	Very poor.
SbE*:							
Samsil	Very poor	Very poor	Fair	Poor	Fair	Very poor	Very poor.
Rock outcrop.							
SdA, SdB Satanta	Fair	Good	Good	Good	Very poor	Very poor	Very poor.
St Stetter	Poor	Fair	Fair	Fair	Poor	Very poor	Very poor.
SwA Swanboy	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
SyA*:							
Swanboy	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Slickspots.							
TdB*:							
Tanna	Fair	Fair	Good	Fair	Very poor	Very poor	Very poor.
Delridge	Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas
TdC*:							
Tanna	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
Delridge	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor.
TsB*:							
Tanna	Fair	Fair	Good	Fair	Very poor	Very poor	Very poor.
Savo	Fair	Good	Good	Good	Very poor	Very poor	Very poor.
TsC*:							
Tanna	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor.
Savo	Poor	Good	Good	Good	Very poor	Very poor	Very poor.
TwC*:							
Twilight	Poor	Fair	Good	Poor	Very poor	Very poor	Very poor.
Marmarth	Poor	Good	Good	Poor	Very poor	Very poor	Very poor.
Parchin	Poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
WhC Winler	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
WlC*:							
Winler	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
Lismas	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor.
YaC Yawdim	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AbB, AbC Abor	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
AlB*:					
Absher	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Slickspots.					
AsB, AsC Assinniboine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
AtC*:					
Assinniboine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Twilight	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Ba, Bb Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
BlE*:					
Blackhall	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
BmE*:					
Blackhall	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Twilight	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.
BoE*:					
Bullock	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lardell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength.
Blackhall	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
BpB*:					
Bullock	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
Parchin	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Slight.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
BsB*:					
Bullock	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
Slickspots.					
CaD Cabbart	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CvB Cabbart Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: low strength, depth to rock.
DeC*:					
Delridge	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
Cabbart	Severe: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Moderate: depth to rock, low strength, slope.
EaA Eapa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
EaB, EaC Eapa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
EdB*, EdC*:					
Eapa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Delridge	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
EgB*, EgC*:					
Eapa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Grail	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
GaA Gerdrum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Gc Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Gr Grail	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.
Hb Havre	Slight	Slight	Slight	Slight	Slight.
Hc Havre	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
He Heil	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
HfB*: Hisle	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Slickspots.					
KyA, KyB Kyle	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
La Lardell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength.
LaB Lawther	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
LbE Lismas	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
LcA*: Loburn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Gerdrum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ld Lohmiller	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.
Lg Lohmiller	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.
NaD*: Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Attewan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
NuA, NuB Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
PbB*: Parchin	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Bullock	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: slope, shrink-swell.	Moderate: shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
PeB Pierre	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
PeC Pierre	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
PlE*: Pierre	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
Lismas	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.
PsC*: Pierre	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Samsil	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
RoE*: Rock outcrop.					
Cabbart	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bullock	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SaD Samsil	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
SbE*: Samsil	Severe: depth to rock, slope.	Severe: slope, shrink-swell.	Severe: depth to rock, slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Rock outcrop.					
SdA Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.
SdB Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
St Stetter	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.
SwA Swanboy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
SyA*: Swanboy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Slickspots.					
TdB*, TdC*: Tanna	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Delridge	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
TsB*, TsC*: Tanna	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Savo	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
TwC*: Twilight	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Marmarth	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.
Parchin	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
WhC Winler	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
WlC*: Winler	Moderate: too clayey, depth to rock, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
Lismas	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
YaC Yawdim	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbB Abor	Severe: depth to rock, percs slowly.	Severe: seepage.	Slight	Slight	Poor: area reclaim, hard to pack.
AbC Abor	Severe: depth to rock, percs slowly.	Severe: slippage, seepage, slope.	Slight	Slight	Poor: area reclaim, hard to pack.
AlB*: Absher	Severe: percs slowly.	Moderate: slope.	Severe: excess salt.	Slight	Poor: hard to pack.
Slickspots.					
AsB Assinniboine	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer.
AsC Assinniboine	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Slight	Fair: thin layer.
AtC*: Assinniboine	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Slight	Fair: thin layer.
Twilight	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Ba, Bb Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
BlE*: Blackhall	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Rock outcrop.					
BmE*: Blackhall	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Twilight	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
BoE*: Bullock	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Lardell	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness, excess salt.	Severe: wetness.	Poor: excess salt.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BoE*: Blackhall	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
BpB*: Bullock	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Parchin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
BsB*: Bullock	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Slickspots.					
CaD Cabbart	Severe: depth to rock, percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
CvB Cabbart Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
DeC*: Delridge	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Cabbart	Severe: depth to rock, percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: area reclaim, thin layer.
EaA Eapa	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
EaB Eapa	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
EaC Eapa	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
EdB*: Eapa	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Delridge	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
EdC*: Eapa	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Delridge	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
EgB*: Eapa	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
EgB*: Grail	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
EgC*: Eapa	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Grail	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
GaA Gerdrum	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Poor: hard to pack.
Gc Glenberg	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
Gr Grail	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Hb Havre	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Hc Havre	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
He Heil	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey, excess sodium.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
HfB*: hisle	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Slickspots.					
KyA Kyle	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
KyB Kyle	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: hard to pack, too clayey.
La Lardell	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness, excess salt.	Severe: wetness.	Poor: excess salt.
LaB Lawther	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LbE Lismas	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
LcA*: Loburn	Severe: percs slowly.	Slight	Slight	Slight	Poor: hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LcA*:					
Gerdrum	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Poor: hard to pack.
Ld Lohmiller	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Poor: hard to pack.
Lg Lohmiller	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
NaD*:					
Nihill	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Attewan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage. ,	Poor: seepage, too sandy, small stones.
NuA Nunn	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NuB Nunn	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PbB*:					
Parchin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Bullock	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
PeB Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PeC Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
PlE*:					
Pierre	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Lismas	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
PsC*:					
Pierre	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Samsil	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
RoE*: Rock outcrop.					

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RoE*: Cabbart	Severe: depth to rock, percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Bullock	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
SaD Samsil	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
SbE*: Samsil	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
SdA Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
SdB Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
St Stetter	Severe: percs slowly, flooding.	Severe: flooding.	Severe: too clayey, flooding.	Severe: flooding.	Poor: too clayey, hard to pack.
SwA Swanboy	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SyA*: Swanboy	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Slickspots.					
TdB*: Tanna	Severe: depth to rock, percs slowly.	Severe: seepage.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey.
Delridge	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
TdC*: Tanna	Severe: depth to rock, percs slowly.	Severe: seepage, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey.
Delridge	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
TsB*: Tanna	Severe: depth to rock, percs slowly.	Severe: seepage.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TsB*: Savo	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
TsC*: Tanna	Severe: depth to rock, percs slowly.	Severe: seepage, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey.
Savo	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
TwC*: Twilight	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Karmarth	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Parchin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
WhC Winler	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim, hard to pack.
WlC*: Winler	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim, hard to pack.
Lismas	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
YaC Yawdim	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AbB, AbC Abor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
AlB*: Absher	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Slickspots.				
AsB, AsC Assinniboine	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AtC*: Assinniboine	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Twilight	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Ba Bankard	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
Bb Bankard	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
BlE*: Blackhall	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
BmE*: Blackhall	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Twilight	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer, slope.
BoE*: Bullock	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, excess sodium.
Lardell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	
Blackhall	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
BpB*: Bullock	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BpB*: Parchin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
BsB*: Bullock	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Slickspots.				
CaD Cabbart	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer, slope.
CvB Cabbart Variant	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
DeC*: Delridge	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Cabbart	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
EaA, EaB, EaC Eapa	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Slight.
EdB*, EdC*: Eapa	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Slight.
Delridge	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
EgB*, EgC*: Eapa	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Slight.
Grail	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
GaA Gerdrum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
Gc Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Gr Grail	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hb, Hc Havre	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
He Heil	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess sodium.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HfB*: Hisle	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Slickspots.				
KyA, KyB Kyle	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
La Lardell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
LaB Lawther	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LbE Lismas	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
LcA*: Loburn	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Gerdrum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
Ld Lohmiller	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lg Lohmiller	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
NaD*: Nihill	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Attewan	Good	Probable	Probable	Poor: small stones, area reclaim.
NuA, NuB Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
PbB*: Parchin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Bullock	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
PeB, PeC Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PlE*: Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Lismas	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
PsC*: Pierre	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
RoE*: Rock outcrop.				
Cabbart	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer, slope.
Bullock	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, excess sodium.
SaD Samsil	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
SbE*: Samsil	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, slope.
Rock outcrop.				
SdA, SdB Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
St Stetter	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SwA Swanboy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SyA*: Swanboy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Slickspots.				
TdB*, TdC*: Tanna	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TdB*, TdC*: Delridge	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
TsB*, TsC*: Tanna	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
Savo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
TwC*: Twilight	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Marmarth	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Parchin	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
WhC Winler	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WlC*: Winler	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Lismas	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
YaC Yawdim	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AbB, AbC Abor	Severe: seepage.	Severe: hard to pack, thin layer.	Deep to water	Slow intake, percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
AlB*:						
Absher	Moderate: slope.	Severe: excess sodium, excess salt.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily, percs slowly.	Excess salt, excess sodium, erodes easily.
Slickspots.						
AsB, AsC Assinniboine	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
AtC*:						
Assinniboine	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Twilight	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing, depth to rock.	Depth to rock, soil blowing.	Droughty, depth to rock.
Ba Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
Bb Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
BlE*:						
Blackhall	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.						
BmE*:						
Blackhall	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Twilight	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, droughty, depth to rock.
BoE*:						
Bullock	Severe: slope.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Slope, depth to rock, soil blowing.	Slope, droughty, excess sodium.
Lardell	Moderate: slope.	Severe: piping, wetness, excess salt.	Percs slowly, excess salt.	Wetness, percs slowly, excess salt.	Erodes easily, wetness, percs slowly.	Excess salt, erodes easily, droughty.
Blackhall	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BpB*: Bullock	Moderate: seepage, depth to rock.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Depth to rock, soil blowing.	Droughty, excess sodium.
Parchin	Moderate: seepage, depth to rock.	Severe: piping, excess sodium.	Deep to water	Soil blowing, percs slowly.	Depth to rock, soil blowing.	Excess sodium, depth to rock.
BsB*: Bullock	Moderate: seepage, depth to rock.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Depth to rock, soil blowing.	Droughty, excess sodium.
Slickspots.						
CaD Cabbart	Severe: slope.	Severe: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
CvB Cabbart Variant	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
DeC*: Delridge	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Cabbart	Severe: slope.	Severe: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
EaA Eapa	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
EaB, EaC Eapa	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
EdB*, EdC*: Eapa	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
Delridge	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
EgB*, EgC*: Eapa	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
Grail	Moderate: slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
GaA Gerdrum	Moderate: seepage.	Severe: excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
Gc Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Gr Grail	Slight	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Hb Havre	Moderate: seepage.	Severe: piping.	Deep to water	Excess salt	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hc Havre	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
He Heil	Slight	Severe: hard to pack, ponding, excess sodium.	Ponding, percs slowly, excess salt.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, excess sodium, percs slowly.
HfB*: Hisle	Moderate: depth to rock.	Severe: hard to pack, excess sodium.	Deep to water	Excess sodium, percs slowly, depth to rock.	Depth to rock, erodes easily.	Excess sodium, erodes easily.
Slickspots.						
KyA Kyle	Slight	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
KyB Kyle	Moderate: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
La Lardell	Slight	Severe: piping, wetness, excess salt.	Percs slowly, excess salt.	Wetness, percs slowly, excess salt.	Erodes easily, wetness, percs slowly.	Excess salt, erodes easily, droughty.
LaB Lawther	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Excess salt, percs slowly.
LbE Lismas	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, depth to rock.
LcA*: Loburn	Slight	Severe: excess sodium.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Erodes easily, excess sodium.
Gerdrum	Moderate: seepage.	Severe: excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Erodes easily, percs slowly.	Excess sodium, erodes easily, droughty.
Ld Lohmiller	Slight	Moderate: hard to pack, piping.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Lg Lohmiller	Slight	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, flooding.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
NaD*: Nihill	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Attewan	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Erodes easily, too sandy.	Erodes easily, droughty.
NuA Nunn	Slight	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
NuB Nunn	Moderate: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PbB*: Parchin	Moderate: seepage, depth to rock, slope.	Severe: piping, excess sodium.	Deep to water	Soil blowing, percs slowly.	Depth to rock, soil blowing.	Excess sodium, depth to rock.
Bullock	Moderate: seepage, depth to rock, slope.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Depth to rock, soil blowing.	Droughty, excess sodium.
PeB Pierre	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
PeC Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
PlE*: Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Lismas	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, depth to rock.
PsC*: Pierre	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
RoE*: Rock outcrop.						
Cabbart	Severe: slope.	Severe: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Bullock	Severe: slope.	Severe: piping, excess sodium.	Deep to water	Droughty, percs slowly, excess sodium.	Slope, depth to rock, soil blowing.	Slope, droughty, excess sodium.
SaD Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SbE*: Samsil	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Rock outcrop.						
SdA Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
SdB Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
St Stetter	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Percs slowly, erodes easily.	Percs slowly, erodes easily, droughty.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
SwA Swanboy	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, excess salt.	Percs slowly, erodes easily.	Erodes easily, percs slowly, excess salt.
SyA*: Swanboy	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, excess salt.	Percs slowly, erodes easily.	Erodes easily, percs slowly, excess salt.
Slickspots.						
TdB*, TdC*: Tanna	Severe: seepage.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Delridge	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
TsB*, TsC*: Tanna	Severe: seepage.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Savo	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
TwC*: Twilight	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing, depth to rock.	Depth to rock, soil blowing.	Droughty, depth to rock.
Marmarth	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
Parchin	Moderate: seepage, depth to rock, slope.	Severe: piping, excess sodium.	Deep to water	Soil blowing, percs slowly.	Depth to rock, soil blowing.	Excess sodium, depth to rock.
WhC Winler	Moderate: slope, depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Depth to rock, erodes easily.	Erodes easily, droughty.
WlC*: Winler	Severe: slope.	Severe: hard to pack.	Deep to water	Slow intake, droughty, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Lismas	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, erodes easily.	Slope, droughty, depth to rock.
YaC Yawdim	Severe: depth to rock.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AbB, AbC---------- Abor	0-5	Silty clay-------	CL, CH	A-7	0	95-100	90-100	80-100	75-95	40-60	20-35
	5-27	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	80-100	75-100	65-100	60-95	35-65	20-45
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
AlB*: Absher-----------	0-2	Silt loam---------	CL	A-6	0	95-100	75-100	70-100	60-90	25-40	10-20
	2-19	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	75-100	70-100	60-95	40-60	20-40
	19-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	95-100	75-100	70-100	60-95	40-55	20-35
Slickspots.											
AsB, AsC---------- Assinniboine	0-7	Fine sandy loam	ML, SM	A-4	0	85-100	75-100	65-90	35-60	15-25	NP-5
	7-16	Sandy clay loam, fine sandy loam.	CL-ML, SM-SC	A-4	0	80-100	75-100	65-95	40-65	25-30	5-10
	16-60	Fine sandy loam, sandy loam.	ML, SM	A-4	0	85-100	75-100	60-85	35-60	20-25	NP-5
AtC*: Assinniboine----	0-7	Fine sandy loam	ML, SM	A-4	0	85-100	75-100	65-90	35-60	15-25	NP-5
	7-16	Sandy clay loam, fine sandy loam.	CL-ML, SM-SC	A-4	0	80-100	75-100	65-95	40-65	25-30	5-10
	16-60	Fine sandy loam, sandy loam.	ML, SM	A-4	0	85-100	75-100	60-85	35-60	20-25	NP-5
Twilight---------	0-10	Fine sandy loam	SM	A-4	0	100	100	60-90	35-50	20-30	NP-5
	10-36	Fine sandy loam, sandy loam.	SM	A-4	0	100	100	60-90	35-50	20-30	NP-5
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ba--------------- Bankard	0-4	Loamy fine sand	SM	A-2	0	95-100	90-100	50-90	15-35	---	NP
	4-60	Stratified fine sand to sandy loam.	SM, SP-SM	A-2	0	95-100	75-100	60-80	10-25	---	NP
Bb--------------- Bankard	0-6	Gravelly loamy sand.	SP-SM, SM	A-2, A-3	0	95-100	80-100	50-75	5-25	---	NP
	6-60	Gravelly fine sand, very gravelly loamy sand, very gravelly sand.	GP, SP, GP-GM, SP-SM	A-1, A-2, A-3	0-5	35-75	35-75	20-60	0-15	---	NP
BlE*: Blackhall-------	0-11	Fine sandy loam	SM, SM-SC	A-4	0-5	90-100	90-100	65-85	40-50	10-20	NP-5
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
BmE*: Blackhall-------	0-11	Fine sandy loam	SM, SM-SC	A-4	0-5	90-100	90-100	65-85	40-50	10-20	NP-5
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Twilight---------	0-10	Fine sandy loam	SM	A-4	0	100	100	60-90	35-50	20-30	NP-5
	10-36	Fine sandy loam, sandy loam.	SM	A-4	0	100	100	60-90	35-50	20-30	NP-5
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BoE*: Bullock----------	0-4	Fine sandy loam	SM, ML	A-4	0	100	100	85-100	40-55	20-30	NP-7
	4-9	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	100	100	75-95	40-80	30-40	8-15
	9-22	Sandy loam, loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	75-95	35-75	25-35	5-15
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BoE*: Lardell	0-1	Fine sandy loam	CH, CL	A-7	0	100	100	95-100	90-95	40-60	20-40
	1-60	Stratified fine sandy loam to silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	80-90	65-85	25-40	15-20
Blackhall	0-11	Fine sandy loam	SM, SM-SC	A-4	0-5	90-100	90-100	65-85	40-50	10-20	NP-5
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BpB*: Bullock	0-4	Fine sandy loam	SM, ML	A-4	0	100	100	85-100	40-55	20-30	NP-7
	4-9	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	100	100	75-95	40-80	30-40	8-15
	9-22	Sandy loam, loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	75-95	35-75	25-35	5-15
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Parchin	0-3	Fine sandy loam	SM, SM-SC	A-4	0	100	100	90-100	35-50	20-30	NP-7
	3-12	Fine sandy loam, loamy fine sand.	SM	A-2, A-4	0	100	100	90-100	15-45	<30	NP-5
	12-19	Sandy clay loam, loam.	SC, SM, CL, ML	A-4, A-6	0	100	100	90-100	35-60	30-40	5-15
	19-32	Fine sandy loam, loam, sandy clay loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	90-100	40-60	25-35	5-10
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BsB*: Bullock	0-4	Fine sandy loam	SM, ML	A-4	0	100	100	85-100	40-55	20-30	NP-7
	4-9	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	100	100	75-95	40-80	30-40	8-15
	9-22	Sandy loam, loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	75-95	35-75	25-35	5-15
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Slickspots.											
CaD Cabbart	0-3	Loam	CL-ML	A-4	0	90-100	85-100	65-85	55-75	25-30	5-10
	3-15	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	90-100	85-100	60-90	55-85	25-35	5-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CvB Cabbart Variant	0-2	Loam	ML, CL	A-4, A-6, A-7	0	95-100	90-100	85-100	60-85	30-45	7-20
	2-12	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	95-100	90-100	80-95	55-85	30-45	7-20
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
DeC*: Delridge	0-3	Loam	CL	A-4, A-6	0	95-100	95-100	85-100	65-90	30-40	8-15
	3-24	Loam, silt loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	30-45	10-20
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Cabbart	0-3	Loam	CL-ML	A-4	0	90-100	85-100	65-85	55-75	25-30	5-10
	3-15	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	90-100	85-100	60-90	55-85	25-35	5-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
EaA, EaB, EaC Eapa	0-4	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	55-85	30-45	7-20
	4-23	Clay loam, sandy clay loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	85-100	75-95	55-85	35-50	10-25
	23-37	Loam, sandy clay loam, clay loam.	CL	A-4, A-6, A-7	0-5	95-100	85-100	75-95	55-85	30-45	8-20
	37-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	80-100	75-95	50-80	30-45	8-20

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EdB*, EdC*: Eapa	0-4	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	55-85	30-45	7-20
	4-23	Clay loam, sandy clay loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	85-100	75-95	55-85	35-50	10-25
	23-37	Loam, sandy clay loam, clay loam.	CL	A-4, A-6, A-7	0-5	95-100	85-100	75-95	55-85	30-45	8-20
	37-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	80-100	75-95	50-80	30-45	8-20
Delridge	0-3	Loam	CL	A-4, A-6	0	95-100	95-100	85-100	65-90	30-40	8-15
	3-24	Loam, silt loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	30-45	10-20
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
EgB*: Eapa	0-4	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	55-85	30-45	7-20
	4-23	Clay loam, sandy clay loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	85-100	75-95	55-85	35-50	10-25
	23-37	Loam, sandy clay loam, clay loam.	CL	A-4, A-6, A-7	0-5	95-100	85-100	75-95	55-85	30-45	8-20
	37-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	80-100	75-95	50-80	30-45	8-20
Grail	0-8	Silt loam	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-45	10-25
	8-21	Silty clay, silty clay loam, clay.	CL, CH, ML	A-7, A-6	0	100	95-100	95-100	70-95	35-60	10-35
	21-60	Clay loam, silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-95	30-55	10-30
EgC*: Eapa	0-4	Loam	CL, ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	55-85	30-45	7-20
	4-23	Clay loam, sandy clay loam, silty clay loam.	CL, ML	A-6, A-7	0-5	95-100	85-100	75-95	55-85	35-50	10-25
	23-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	95-100	80-100	75-95	50-80	30-45	8-20
Grail	0-8	Silt loam	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-45	10-25
	8-21	Silty clay, silty clay loam, clay.	CL, CH, ML	A-7, A-6	0	100	95-100	95-100	70-95	35-60	10-35
	21-60	Clay loam, silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-95	30-55	10-30
GaA Gerdrum	0-4	Loam	CL-ML	A-4	0	80-100	75-100	60-90	50-80	25-30	5-10
	4-15	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	90-100	90-100	85-100	75-95	40-60	20-40
	15-60	Clay loam, sandy clay loam, clay.	CL, SC, CH	A-6, A-7	0	90-100	90-100	80-95	45-75	35-55	15-35
Gc Glenberg	0-4	Fine sandy loam	SM, SM-SC	A-4, A-2	0	95-100	85-100	60-80	30-45	20-30	NP-7
	4-60	Stratified loamy sand to loam.	SM	A-2, A-4	0	90-100	75-100	50-70	25-40	<25	NP-5
Gr Grail	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	8-21	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	21-60	Silty clay loam, silt loam, clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
Hb Havre	0-5	Loam	CL-ML	A-4	0	100	100	80-95	60-90	20-30	5-10
	5-60	Stratified fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	100	100	80-95	60-80	20-35	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Hc---------------- Havre	0-5	Loam----------------	ML, CL-ML	A-4	0	100	100	80-95	60-75	20-30	NP-10
	5-60	Stratified fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	100	100	80-95	50-70	20-35	5-15
He---------------- Heil	0-3	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	25-50	10-25
	3-20	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	50-70	25-45
	20-60	Silty clay, silty clay loam, clay.	CH, CL	A-7, A-6	0	100	100	85-100	60-95	25-60	11-45
HfB*:											
Hisle-------------	0-1	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	1-28	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	28-60	Weathered bedrock	CH	A-7	0	100	95-100	95-100	85-100	50-90	30-60
Slickspots.											
KyA, KyB---------- Kyle	0-2	Clay----------------	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
	2-22	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	80-100	55-75	25-45
	22-60	Clay----------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	25-55
La---------------- Lardell	0-1	Fine sandy loam	CH, CL	A-7	0	100	100	95-100	90-95	40-60	20-40
	1-60	Stratified fine sandy loam to silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	80-90	65-85	25-40	15-20
LaB--------------- Lawther	0-7	Silty clay--------	CL, CH	A-7	0	100	100	90-100	75-100	45-70	25-40
	7-26	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	75-100	35-70	15-40
	26-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	75-100	35-70	15-40
LbE--------------- Lismas	0-3	Clay----------------	CH, MH	A-7	0	100	100	95-100	80-100	60-90	30-50
	3-11	Shaly clay, shaly silty clay, clay.	CH, MH	A-7	0	90-100	75-100	70-100	60-100	60-90	30-50
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
LcA*:											
Loburn------------	0-8	Loam----------------	ML, CL	A-4, A-6	0	100	100	85-95	60-75	30-40	5-15
	8-16	Silty clay, clay, silty clay loam.	CH, MH	A-7	0	100	100	90-100	75-100	50-75	20-42
	16-24	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	90-100	75-100	50-75	23-42
	24-60	Silty clay, sandy clay loam, clay loam.	CL, CH	A-7	0	100	100	90-100	75-100	45-65	20-35
Gerdrum-----------	0-4	Silt loam---------	CL-ML	A-4	0	80-100	75-100	60-90	50-80	25-30	5-10
	4-15	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	90-100	90-100	85-100	75-95	40-60	20-40
	15-60	Clay loam, sandy clay loam, clay.	CL, SC, CH	A-6, A-7	0	90-100	90-100	80-95	45-75	35-55	15-35
Ld---------------- Lohmiller	0-4	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	4-23	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	12-30
	23-60	Stratified fine sandy loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	65-95	35-60	12-30
Lg---------------- Lohmiller	0-4	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	4-23	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	15-30
	23-60	Stratified fine sandy loam to clay.	CL, ML, CL-ML	A-4, A-6	0	95-100	95-100	90-100	65-75	25-40	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NaD*:											
Nihill	0-4	Gravelly loam	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	4-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM	A-2, A-1	0-15	30-60	20-50	15-40	10-35	20-35	NP-10
Attewan	0-4	Loam	ML, CL-ML	A-4	0-5	85-100	80-100	70-90	55-75	20-30	NP-10
	4-16	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0-5	75-100	70-100	55-85	35-70	30-40	10-20
	16-28	Clay loam, loam, sandy clay loam.	CL, SC, GC	A-6	0-5	70-100	65-100	50-85	35-65	30-40	10-20
	28-60	Very gravelly loamy sand, extremely gravelly loamy sand, very gravelly sand.	GP, GP-GM, GM, SM	A-1	0-15	25-55	15-50	5-20	0-15	---	NP
NuA, NuB	0-7	Clay loam	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
Nunn	7-26	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	26-60	Clay loam, loam, gravelly sandy loam.	CL, SC, ML, SM	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	5-20
PbB*:											
Parchin	0-3	Fine sandy loam	SM, SM-SC	A-4	0	100	100	90-100	35-50	20-30	NP-7
	3-12	Fine sandy loam, loamy fine sand.	SM	A-2, A-4	0	100	100	90-100	15-45	<30	NP-5
	12-19	Sandy clay loam, loam.	SC, SM, CL, ML	A-4, A-6	0	100	100	90-100	35-60	30-40	5-15
	19-32	Fine sandy loam, loam, sandy clay loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	90-100	40-60	25-35	5-10
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bullock	0-4	Fine sandy loam	SM, ML	A-4	0	100	100	85-100	40-55	20-30	NP-7
	4-9	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	100	100	75-95	40-80	30-40	8-15
	9-22	Sandy loam, loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	75-95	35-75	25-35	5-15
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
PeB, PeC	0-3	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
Pierre	3-15	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	15-28	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	28-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
PlE*:											
Pierre	0-3	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	3-15	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	15-28	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	28-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45
Lismas	0-3	Clay	CH, MH	A-7	0	100	100	95-100	80-100	60-90	30-50
	3-11	Shaly clay, shaly silty clay, clay.	CH, MH	A-7	0	90-100	75-100	70-100	60-100	60-90	30-50
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
PsC*:											
Pierre	0-3	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	3-15	Clay	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	15-28	Shaly clay, clay	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	28-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-45

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PsC*:											
Samsil----------	0-7	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	7-13	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	13-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
RoE*:											
Rock outcrop.											
Cabbart---------	0-3	Loam-------------	CL-ML	A-4	0	90-100	85-100	65-85	55-75	25-30	5-10
	3-15	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	90-100	85-100	60-90	55-85	25-35	5-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bullock---------	0-4	Fine sandy loam	SM, ML	A-4	0	100	100	85-100	40-55	20-30	NP-7
	4-9	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	100	100	75-95	40-80	30-40	8-15
	9-22	Sandy loam, loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	100	100	75-95	35-75	25-35	5-15
	22-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
SaD--------------	0-7	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
Samsil	7-13	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	13-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
SbE*:											
Samsil----------	0-7	Clay-------------	CH, MH	A-7	0	100	85-100	80-100	70-100	50-85	20-50
	7-13	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	18-55
	13-60	Weathered bedrock	CH, MH	A-7	0	100	95-100	90-100	85-100	50-90	20-55
Rock outcrop.											
SdA, SdB---------	0-6	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
Satanta	6-16	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	16-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
St---------------	0-3	Clay-------------	CH	A-7	0	100	100	90-100	75-100	50-90	25-65
Stetter	3-60	Clay-------------	CH	A-7	0	100	100	90-100	75-100	50-90	25-65
SwA--------------	0-22	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
Swanboy	22-60	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
SyA*:											
Swanboy---------	0-22	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
	22-60	Clay-------------	CH, MH	A-7	0	100	100	90-100	75-95	50-100	20-60
Slickspots.											
TdB*, TdC*:											
Tanna-----------	0-5	Silty clay loam	CL	A-6	0-5	90-100	90-100	90-100	85-95	35-40	15-20
	5-32	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0-5	90-100	90-100	80-95	75-90	35-45	15-25
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Delridge--------	0-3	Silt loam--------	CL	A-4, A-6	0	95-100	95-100	85-100	65-90	30-40	8-15
	3-24	Loam, silt loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	30-45	10-20
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
TsB*, TsC*:											
Tanna-----------	0-5	Silty clay loam	CL	A-6	0-5	90-100	90-100	90-100	85-95	35-40	15-20
	5-32	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0-5	90-100	90-100	80-95	75-90	35-45	15-25
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TsB*, TsC*:											
Savo	0-4	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	5-20
	4-18	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	15-35
	18-30	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-95	40-55	15-30
	30-60	Silty clay loam, silt loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-100	35-55	12-30
TwC*:											
Twilight	0-10	Fine sandy loam	SM	A-4	0	100	100	60-90	35-50	20-30	NP-5
	10-36	Fine sandy loam, sandy loam.	SM	A-4	0	100	100	60-90	35-50	20-30	NP-5
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Marmarth	0-4	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-85	40-55	15-25	NP-5
	4-16	Clay loam, loam, sandy clay loam.	ML, CL, CL-ML	A-6, A-4	0	100	100	90-100	60-80	20-40	3-20
	16-28	Loam, fine sandy loam, clay loam.	ML, CL, CL-ML	A-6, A-4	0	100	100	90-100	60-80	15-40	3-20
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Parchin	0-3	Fine sandy loam	SM, SM-SC	A-4	0	100	100	90-100	35-50	20-30	NP-7
	3-12	Fine sandy loam, loamy fine sand.	SM	A-2, A-4	0	100	100	90-100	15-45	<30	NP-5
	12-19	Sandy clay loam, loam.	SC, SM, CL, ML	A-4, A-6	0	100	100	90-100	35-60	30-40	5-15
	19-32	Fine sandy loam, loam, sandy clay loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	90-100	40-60	25-35	5-10
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
WhC Winler	0-3	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-95	30-55
	3-15	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-90	30-55
	15-23	Shaly clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	65-90	30-55
	23-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	65-90	30-55
WlC*:											
Winler	0-3	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-95	30-55
	3-15	Clay	CH, MH	A-7	0	100	100	90-100	80-100	65-90	30-55
	15-23	Shaly clay, clay	CH, MH	A-7	0	95-100	70-100	60-100	50-100	65-90	30-55
	23-60	Weathered bedrock	CH, MH	A-7	0	100	100	90-100	80-100	65-90	30-55
Lismas	0-3	Clay	CH, MH	A-7	0	100	100	95-100	80-100	60-90	30-50
	3-11	Shaly clay, shaly silty clay, clay.	CH, MH	A-7	0	90-100	75-100	70-100	60-100	60-90	30-50
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
YaC Yawdim	0-2	Silty clay loam	CL	A-7, A-6	0	100	100	90-100	70-95	25-45	10-25
	2-19	Silty clay, clay loam; clay.	CL, CH	A-7	0	100	100	90-100	70-95	40-60	15-30
	19-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/In	pH	mmhos/cm					Pct
AbB, AbC	0-5	0.2-0.6	0.14-0.18	7.4-8.4	<4	High	0.37	4	4	1-2
Abor	5-27	<0.2	0.12-0.16	7.4-9.0	<4	High	0.37			
	27-60	---	---	---	---	---	----			
AlB*:										
Absher	0-2	0.06-0.2	0.12-0.16	6.6-8.4	4-8	Moderate	0.43	1	6	1-2
	2-19	<0.06	0.08-0.12	6.6-8.4	8-16	High	0.37			
	19-60	<0.06	0.04-0.10	>7.8	>8	High	0.43			
Slickspots.										
AsB, AsC	0-7	0.6-2.0	0.13-0.16	6.6-7.8	<2	Low	0.24	5	3	2-4
Assinniboine	7-16	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low	0.32			
	16-60	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low	0.24			
AtC*:										
Assinniboine	0-7	0.6-2.0	0.13-0.16	6.6-7.8	<2	Low	0.24	5	3	2-4
	7-16	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low	0.32			
	16-60	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low	0.24			
Twilight	0-10	2.0-6.0	0.10-0.14	6.1-7.8	<2	Low	0.24	4	3	1-2
	10-36	2.0-6.0	0.09-0.13	6.6-8.4	<2	Low	0.24			
	36-60	---	---	---	---	---	----			
Ba	0-4	6.0-20	0.10-0.15	6.6-7.8	<2	Low	0.17	5	2	.5-1
Bankard	4-60	6.0-20	0.07-0.15	6.6-8.4	<2	Low	0.17			
Bb	0-6	6.0-20	0.05-0.08	7.4-8.4	<2	Low	0.10	5	2	.5-1
Bankard	6-60	>20	0.05-0.06	7.4-9.0	<2	Low	0.10			
BlE*:										
Blackhall	0-11	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	0.24	2	3	1-2
	11-60	---	---	---	---	---	----			
Rock outcrop.										
BmE*:										
Blackhall	0-11	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	0.24	2	3	1-2
	11-60	---	---	---	---	---	----			
Twilight	0-10	2.0-6.0	0.10-0.14	6.1-7.8	<2	Low	0.24	4	3	1-2
	10-36	2.0-6.0	0.09-0.13	6.6-8.4	<2	Low	0.24			
	36-60	---	---	---	---	---	----			
BoE*:										
Bullock	0-4	2.0-6.0	0.12-0.15	6.1-7.8	<2	Low	0.24	1	3	1-2
	4-9	<0.2	0.13-0.17	7.4-9.0	2-8	Moderate	0.32			
	9-22	0.06-2.0	0.07-0.15	7.4-9.0	2-8	Moderate	0.32			
	22-60	---	---	---	---	---	----			
Lardell	0-1	0.06-0.2	0.07-0.09	7.9-9.0	>16	High	0.24	5	4	.5-2
	1-60	0.06-0.2	0.07-0.09	>7.8	>16	Moderate	0.37			
Blackhall	0-11	2.0-6.0	0.13-0.15	7.9-8.4	<2	Low	0.24	2	3	1-2
	11-60	---	---	---	---	---	----			
BpB*:										
Bullock	0-4	2.0-6.0	0.12-0.15	6.1-7.8	<2	Low	0.24	1	3	1-2
	4-9	<0.2	0.13-0.17	7.4-9.0	2-8	Moderate	0.32			
	9-22	0.06-2.0	0.07-0.15	7.4-9.0	2-8	Moderate	0.32			
	22-60	---	---	---	---	---	----			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
BpB*:										
Parchin	0-3	2.0-6.0	0.13-0.16	5.1-6.5	<2	Low	0.20	3	3	1-3
	3-12	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low	0.20			
	12-19	<0.2	0.13-0.15	7.4-8.4	2-4	Moderate	0.37			
	19-32	0.6-2.0	0.11-0.13	7.4-9.0	2-8	Low	0.20			
	32-60	---	---	---	---	-----------	----			
BsB*:										
Bullock	0-4	2.0-6.0	0.12-0.15	6.1-7.8	<2	Low	0.24	1	3	1-2
	4-9	<0.2	0.13-0.17	7.4-9.0	2-8	Moderate	0.32			
	9-22	0.06-2.0	0.07-0.15	7.4-9.0	2-8	Moderate	0.32			
	22-60	---	---	---	---	-----------	----			
Slickspots.										
CaD Cabbart	0-3	0.6-2.0	0.17-0.21	7.4-8.4	<4	Low	0.32	2	4L	1-2
	3-15	0.6-2.0	0.15-0.19	7.4-8.4	2-8	Moderate	0.32			
	15-60	---	---	---	---	-----------	----			
CvB Cabbart variant	0-2	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.28	2	6	2-4
	2-12	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.28			
	12-60	---	---	---	---	-----------	----			
DeC*:										
Delridge	0-3	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.32	4	4L	.5-2
	3-24	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	24-60	---	---	---	---	-----------	----			
Cabbart	0-3	0.6-2.0	0.17-0.21	7.4-8.4	<4	Low	0.32	2	4L	1-2
	3-15	0.6-2.0	0.15-0.19	7.4-8.4	2-8	Moderate	0.32			
	15-60	---	---	---	---	-----------	----			
EaA, EaB, EaC Eapa	0-4	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	6	2-4
	4-23	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate	0.28			
	23-37	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.28			
	37-60	0.6-2.0	0.17-0.20	7.4-8.4	<4	Moderate	0.28			
EdB*, EdC*:										
Eapa	0-4	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	6	2-4
	4-23	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate	0.28			
	23-37	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.28			
	37-60	0.6-2.0	0.17-0.20	7.4-8.4	<4	Moderate	0.28			
Delridge	0-3	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.32	4	4L	.5-2
	3-24	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.32			
	24-60	---	---	---	---	-----------	----			
EgB*:										
Eapa	0-4	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	6	2-4
	4-23	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate	0.28			
	23-37	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.28			
	37-60	0.6-2.0	0.17-0.20	7.4-8.4	<4	Moderate	0.28			
Grail	0-8	0.2-0.6	0.22-0.24	6.1-8.4	<2	Moderate	0.32	5	6	4-6
	8-21	0.2-0.6	0.14-0.17	6.6-8.4	<2	High	0.32			
	21-60	0.2-0.6	0.13-0.22	7.4-8.4	<4	Moderate	0.32			
EgC*:										
Eapa	0-4	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.28	5	6	2-4
	4-23	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate	0.28			
	23-60	0.6-2.0	0.17-0.20	7.4-8.4	<4	Moderate	0.28			
Grail	0-8	0.2-0.6	0.22-0.24	6.1-8.4	<2	Moderate	0.32	5	6	4-6
	8-21	0.2-0.6	0.14-0.17	6.6-8.4	<2	High	0.32			
	21-60	0.2-0.6	0.13-0.22	7.4-8.4	<4	Moderate	0.32			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
GaA---------------	0-4	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low----------	0.43	5	6	1-3
Gerdrum	4-15	0.06-0.2	0.10-0.14	7.4-9.0	2-8	High---------	0.32			
	15-60	0.06-0.2	0.07-0.11	7.9-9.0	8-16	High---------	0.37			
Gc---------------	0-4	2.0-6.0	0.11-0.14	7.4-8.4	<2	Low----------	0.24	5	3	.5-2
Glenberg	4-60	2.0-6.0	0.07-0.12	7.4-8.4	<2	Low----------	0.10			
Gr---------------	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	4-6
Grail	8-21	0.2-0.6	0.13-0.18	6.6-7.3	<2	High---------	0.32			
	21-60	0.2-0.6	0.14-0.22	7.4-8.4	<2	Moderate----	0.32			
Hb---------------	0-5	0.6-2.0	0.16-0.20	6.1-8.4	<2	Low----------	0.37	5	4L	.5-2
Havre	5-60	0.6-2.0	0.14-0.18	7.4-9.0	<4	Low----------	0.28			
Hc---------------	0-5	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low----------	0.37	5	4L	.5-2
Havre	5-60	0.6-2.0	0.14-0.18	7.4-8.4	<4	Low----------	0.28			
He---------------	0-3	<0.06	0.15-0.24	5.6-7.3	<2	Moderate----	0.28	3	7	3-4
Heil	3-20	<0.06	0.13-0.18	6.6-9.0	4-16	High---------	0.28			
	20-60	<0.06	0.13-0.18	7.4-9.0	4-16	High---------	0.28			
HfB*:										
Hisle------------	0-1	0.6-2.0	0.16-0.20	6.1-7.8	<2	Low----------	0.28	1	6	1-3
	1-28	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
	28-60	---	---	6.1-8.4	---	-------------	----			
Slickspots.										
KyA, KyB----------	0-2	<0.06	0.08-0.12	6.6-7.8	<2	Very high	0.37	5	4	1-3
Kyle	2-22	<0.06	0.08-0.12	7.4-8.4	<4	Very high	0.37			
	22-60	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
La---------------	0-1	0.06-0.2	0.07-0.09	7.9-9.0	>16	Moderate----	0.32	5	4	.5-2
Lardell	1-60	0.06-0.2	0.07-0.09	>7.8	>16	Moderate----	0.37			
LaB---------------	0-7	0.06-0.2	0.14-0.17	6.6-8.4	<2	High---------	0.32	5	4	2-4
Lawther	7-26	0.06-0.2	0.14-0.17	7.4-9.0	<4	High---------	0.32			
	26-60	0.06-0.2	0.14-0.17	7.9-9.0	4-12	High---------	0.32			
LbE---------------	0-3	<0.06	0.08-0.12	6.1-7.8	<4	Very high	0.37	2	4	1-2
Lismas	3-11	<0.06	0.07-0.11	5.6-7.8	<4	Very high	0.37			
	11-60	---	---	---	---	-------------	----			
LcA*:										
Loburn-----------	0-8	0.6-2.0	0.17-0.19	5.6-7.3	<2	Low----------	0.28	3	6	1-2
	8-16	<0.06	0.07-0.13	6.1-7.8	4-16	High---------	0.37			
	16-24	<0.06	0.07-0.13	7.4-8.4	4-16	High---------	0.37			
	24-60	<0.2	0.07-0.13	7.4-8.4	8-16	High---------	0.37			
Gerdrum----------	0-4	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low----------	0.43	5	6	1-3
	4-15	0.06-0.2	0.10-0.14	7.4-9.0	2-8	High---------	0.32			
	15-60	0.06-0.2	0.07-0.11	7.9-9.0	8-16	High---------	0.37			
Ld---------------	0-4	0.06-0.6	0.14-0.17	6.6-8.4	<4	Moderate----	0.32	5	4L	1-3
Lohmiller	4-23	0.06-0.6	0.11-0.16	6.6-8.4	<4	High---------	0.32			
	23-60	0.06-0.6	0.14-0.16	7.4-8.4	<8	High---------	0.32			
Lg---------------	0-4	0.06-0.6	0.14-0.17	7.4-8.4	<4	Moderate----	0.32	5	4L	1-2
Lohmiller	4-23	0.06-0.6	0.11-0.16	7.4-8.4	<4	High---------	0.32			
	23-60	0.06-0.6	0.14-0.16	7.4-8.4	<4	High---------	0.32			
NaD*:										
Nihill-----------	0-4	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low----------	0.24	2	6	.5-1
	4-60	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low----------	0.10			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
NaD*:										
Attewan----------	0-4	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low----------	0.28	4	6	2-4
	4-16	0.6-2.0	0.14-0.17	6.6-7.8	<2	Moderate----	0.32			
	16-28	0.6-2.0	0.13-0.15	7.4-8.4	<2	Moderate----	0.32			
	28-60	>6.0	0.02-0.03	7.4-8.4	<2	Low----------	0.05			
NuA, NuB---------- Nunn	0-7	0.2-0.6	0.15-0.20	6.1-7.8	<2	Moderate----	0.24	5	6	2-4
	7-26	0.2-0.6	0.15-0.18	6.6-8.4	<2	High--------	0.28			
	26-60	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate----	0.24			
PbB*:										
Parchin----------	0-3	2.0-6.0	0.13-0.16	5.1-6.5	<2	Low----------	0.20	3	3	1-3
	3-12	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low----------	0.20			
	12-19	<0.2	0.13-0.15	7.4-8.4	2-4	Moderate----	0.37			
	19-32	0.6-2.0	0.11-0.13	7.4-9.0	2-8	Low----------	0.20			
	32-60	---	---	---	---	-------------	----			
Bullock---------	0-4	2.0-6.0	0.12-0.15	6.1-7.8	<2	Low----------	0.24	1	3	1-2
	4-9	<0.2	0.13-0.17	7.4-9.0	2-8	Moderate----	0.32			
	9-22	0.06-2.0	0.07-0.15	7.4-9.0	2-8	Moderate----	0.32			
	22-60	---	---	---	---	-------------	----			
PeB, PeC---------- Pierre	0-3	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	3-15	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	15-28	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	28-60	---	---	---	<2	-------------	----			
PlE*:										
Pierre-----------	0-3	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	3-15	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	15-28	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	28-60	---	---	---	<2	-------------	----			
Lismas-----------	0-3	<0.06	0.08-0.12	6.1-7.8	<4	Very high	0.37	2	4	1-2
	3-11	<0.06	0.07-0.11	5.6-7.8	<4	Very high	0.37			
	11-60	---	---	---	---	-------------	----			
PsC*:										
Pierre-----------	0-3	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	3-15	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	15-28	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	28-60	---	---	---	<2	-------------	----			
Samsil-----------	0-7	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	7-13	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	13-60	---	---	---	---	-------------	----			
RoE*: Rock outcrop.										
Cabbart----------	0-3	0.6-2.0	0.17-0.21	7.4-8.4	<4	Low----------	0.32	2	4L	1-2
	3-15	0.6-2.0	0.15-0.19	7.4-8.4	2-8	Moderate----	0.32			
	15-60	---	---	---	---	-------------	----			
Bullock----------	0-4	2.0-6.0	0.12-0.15	6.1-7.8	<2	Low----------	0.24	1	3	1-2
	4-9	<0.2	0.13-0.17	7.4-9.0	2-8	Moderate----	0.32			
	9-22	0.06-2.0	0.07-0.15	7.4-9.0	2-8	Moderate----	0.32			
	22-40	---	---	---	---	-------------	----			
SaD-------------- Samsil	0-7	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	7-13	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	13-60	---	---	---	---	-------------	----			
SbE*:										
Samsil-----------	0-7	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37	2	4	1-3
	7-13	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	13-60	---	---	---	---	-------------	----			
Rock outcrop.										

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
							K	T		
	In	In/hr	In/in	pH	mmhos/cm					Pct
SdA, SdB----------	0-6	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low----------	0.28	5	6	2-4
Satanta	6-16	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate----	0.28			
	16-60	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low----------	0.28			
St----------------	0-3	<0.2	0.08-0.16	6.6-8.4	<2	High---------	0.37	5	4	1-3
Stetter	3-60	<0.2	0.08-0.16	6.6-8.4	<4	High---------	0.37			
SwA---------------	0-22	<0.06	0.08-0.12	6.6-9.0	<2	Very high	0.37	5	4	1-2
Swanboy	22-60	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
SyA*:										
Swanboy----------	0-22	<0.06	0.08-0.12	6.6-9.0	<2	Very high	0.37	5	4	1-2
	22-60	<0.06	0.05-0.12	7.4-9.0	2-16	Very high	0.37			
Slickspots.										
TdB*, TdC*:										
Tanna------------	0-5	0.06-0.2	0.16-0.20	6.6-7.8	<2	Moderate----	0.37	2	7	2-4
	5-32	0.06-0.2	0.14-0.17	6.6-8.4	<4	High---------	0.37			
	32-60	---	---	---	---	-------------	----			
Delridge---------	0-3	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate----	0.32	4	4L	.5-2
	3-24	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate----	0.32			
	24-60	---	---	---	---	-------------	----			
TsB*, TsC*:										
Tanna------------	0-5	0.06-0.2	0.16-0.20	6.6-7.8	<2	Moderate----	0.37	2	7	2-4
	5-32	0.06-0.2	0.14-0.17	6.6-8.4	<4	High---------	0.37			
	32-60	---	---	---	---	-------------	----			
Savo-------------	0-4	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate----	0.32	5	6	2-4
	4-18	0.2-0.6	0.11-0.19	6.1-7.8	<2	High---------	0.43			
	18-30	0.2-0.6	0.11-0.19	7.4-8.4	<2	High---------	0.43			
	30-60	0.2-2.0	0.11-0.17	7.4-8.4	<2	Moderate----	0.43			
TwC*:										
Twilight---------	0-10	2.0-6.0	0.10-0.14	6.1-7.8	<2	Low----------	0.24	4	3	1-2
	10-36	2.0-6.0	0.09-0.13	6.6-8.4	<2	Low----------	0.24			
	36-60	---	---	---	---	-------------	----			
Marmarth---------	0-4	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low----------	0.20	4	3	2-4
	4-16	0.6-2.0	0.14-0.18	6.1-7.8	<2	Moderate----	0.28			
	16-28	0.6-2.0	0.14-0.18	7.4-8.4	<2	Moderate----	0.28			
	28-60	---	---	---	---	-------------	----			
Parchin----------	0-3	2.0-6.0	0.13-0.16	5.1-6.5	<2	Low----------	0.20	3	3	1-3
	3-12	2.0-6.0	0.11-0.14	5.6-7.3	<2	Low----------	0.20			
	12-19	<0.2	0.13-0.15	7.4-8.4	2-4	Moderate----	0.37			
	19-32	0.6-2.0	0.11-0.13	7.4-9.0	2-8	Low----------	0.20			
	32-60	---	---	---	---	-------------	----			
WhC---------------	0-3	<0.06	0.08-0.14	6.1-7.8	<2	Very high	0.37	4	4	1-3
Winler	3-15	<0.06	0.08-0.12	6.6-7.8	2-4	Very high	0.37			
	15-23	<0.06	0.08-0.12	5.6-8.4	2-4	Very high	0.37			
	23-60	---	---	4.5-7.8	---	-------------	----			
WlC*:										
Winler-----------	0-3	<0.06	0.08-0.14	6.1-7.8	<2	Very high	0.37	4	4	1-3
	3-15	<0.06	0.08-0.12	6.6-7.8	2-4	Very high	0.37			
	15-23	<0.06	0.08-0.12	5.6-8.4	2-4	Very high	0.37			
	23-60	---	---	4.5-7.8	---	-------------	----			
Lismas-----------	0-3	<0.06	0.08-0.12	6.1-7.8	<4	Very high	0.37	2	4	1-2
	3-11	<0.06	0.07-0.11	5.6-7.8	<4	Very high	0.37			
	11-60	---	---	---	---	-------------	----			
YaC---------------	0-2	0.2-0.6	0.17-0.23	6.6-7.8	<2	Moderate----	0.32	2	4L	<1
Yawdim	2-19	0.06-0.2	0.14-0.20	7.4-8.4	<2	High---------	0.32			
	19-60	---	---	---	---	-------------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AbB, AbC Abor	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
AlB*: Absher	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Slickspots.												
AsB, AsC Assinniboine	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
AtC*: Assinniboine	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Twilight	B	None	---	---	>6.0	---	---	20-40	Soft	Low	Moderate	Low.
Ba Bankard	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low	Moderate	Low.
Bb Bankard	A	Frequent	Brief	Mar-Jun	>6.0	---	---	>60	---	Low	Moderate	Low.
BlE*: Blackhall	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
Rock outcrop.												
BmE*: Blackhall	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
Twilight	B	None	---	---	>6.0	---	---	20-40	Soft	Low	Moderate	Low.
BoE*: Bullock	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Lardell	C	None	---	---	1.5-3.0	Apparent	May-Aug	>60	---	Moderate	High	High.
Blackhall	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
BpB*: Bullock	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Parchin	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
BsB*: Bullock	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Slickspots.												

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
CaD Cabbart	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
CvB **Cabbart Variant**	D	None	---	---	>6.0	---	---	5-20	Hard	Low	Moderate	Low.
DeC*:												
Delridge	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
Cabbart	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
EaA, EaB, EaC Eapa	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
EdB*, EdC*:												
Eapa	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Delridge	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
EgB*, EgC*:												
Eapa	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Grail	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
GaA Gerdrum	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Gc **Glenberg**	B	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
Gr Grail	C	Frequent	Very brief	Mar-Oct	>6.0	---	---	>60	---	Moderate	High	Low.
Hb **Havre**	B	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
Hc Havre	B	Frequent	Brief	Apr-Jun	>6.0	---	---	>60	---	Moderate	High	Low.
He **Heil**	D	None	---	---	+1-1.0	Apparent	Mar-Sep	>60	---	Moderate	High	Moderate.
HfB*:												
Hisle	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Slickspots.												
KyA, KyB **Kyle**	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
La Lardell	C	Rare	---	---	1.5-3.0	Apparent	May-Aug	>60	---	Moderate	High	High.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
LaB Lawther	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
LbE Lismas	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
LoA*:												
Loburn	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Gerdrum	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Ld Lohmiller	C	Rare	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Lg Lohmiller	C	Frequent	Brief	Mar-Sep	>6.0	---	---	>60	---	Low	High	Moderate.
NaD*:												
Nihill	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Attewan	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
NuA, NuB Nunn	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
PbB*:												
Parchin	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Bullock	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
PeB, PeC Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
PlE*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Lismas	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
PsC*:												
Pierre	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
RoE*: Rock outcrop.												
Cabbart	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Bullock	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
SaD Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
SbE*: Samsil	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Rock outcrop.												
SdA, SdB Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
St Stetter	D	Frequent	Brief	Mar-Oct	>6.0	---	---	>60	---	Low	High	Low.
SwA Swanboy	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
SyA*: Swanboy	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
Slickspots.												
TdB*, TdC*: Tanna	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Delridge	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
TsB*, TsC*: Tanna	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Savo	C	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
TwC*: Twilight	B	None	---	---	>6.0	---	---	20-40	Soft	Low	Moderate	Low.
Marmarth	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Parchin	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WhC Winler	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
WlC*: Winler	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Lismas	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
YaC Yawdim	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Abor	Fine, montmorillonitic, frigid Udorthentic Chromusterts
Absher	Fine, montmorillonitic Borollic Natrargids
Assinniboine	Fine-loamy, mixed Aridic Argiborolls
Attewan	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
*Blackhall	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents
Bullock	Fine-loamy, mixed Borollic Natrargids
Cabbart	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents
Cabbart Variant	Loamy, mixed Lithic Haploborolls
Delridge	Fine-loamy, mixed (calcareous), frigid Ustic Torriorthents
Eapa	Fine-loamy, mixed Aridic Argiborolls
Gerdrum	Fine, montmorillonitic Borollic Natrargids
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Grail	Fine, montmorillonitic Pachic Argiborolls
Havre	Fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents
Heil	Fine, montmorillonitic, frigid Typic Natraquolls
Hisle	Fine, montmorillonitic, mesic Ustollic Natrargids
Kyle	Very fine, montmorillonitic, mesic Ustertic Camborthids
Lardell	Fine-loamy, mixed, frigid Aquollic Salorthids
Lawther	Fine, montmorillonitic Vertic Haploborolls
Lismas	Clayey, montmorillonitic, nonacid, mesic, shallow Ustic Torriorthents
Loburn	Fine, montmorillonitic Borollic Natrargids
Lohmiller	Fine, montmorillonitic (calcareous), mesic Ustic Torrifluvents
Marmarth	Fine-loamy, mixed Aridic Argiborolls
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Parchin	Fine-loamy, mixed Borollic Natrargids
Pierre	Very fine, montmorillonitic, mesic Ustertic Camborthids
Samsil	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Savo	Fine, montmorillonitic, mesic Aridic Argiustolls
Stetter	Fine, montmorillonitic, nonacid, mesic Ustertic Torrifluvents
Swanboy	Very fine, montmorillonitic, mesic Ustertic Camborthids
Tanna	Fine, montmorillonitic Aridic Argiborolls
Twilight	Coarse-loamy, mixed Borollic Camborthids
Winler	Very fine, montmorillonitic, mesic Ustertic Camborthids
Yawdim	Clayey, montmorillonitic (calcareous), frigid, shallow Ustic Torriorthents

Interpretive Groups

INTERPRETIVE GROUPS

[Dashes indicate that the soil is not assigned to the interpretive group]

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
AbB Abor	IVe-3	Clayey	4C
AbC Abor	IVe-14	Clayey	4C
AlB:			
Absher	VIs-3	Thin Claypan	10
Slickspots	VIIIs-3	---	---
AsB Assinniboine	IVe-6	Sandy	5
AsC Assinniboine	IVe-7	Sandy	5
AtC:			
Assinniboine	IVe-7	Sandy	5
Twilight	IVe-7	Sandy	6R
Ba Bankard	VIe-8	Sands	7
Bb Bankard	VIw-3	Sands	10
BlE:			
Blackhall	VIIe-3	Shallow	10
Rock outcrop	VIIIs-1	---	---
BmE:			
Blackhall	VIIe-3	Shallow	10
Twilight	VIe-7	Sandy	10
BoE:			
Bullock	VIs-3	Thin Claypan	10
Lardell	VIw-3	Saline Lowland	10
Blackhall	VIIe-3	Shallow	10
BpB:			
Bullock	VIs-3	Thin Claypan	10
Parchin	VIs-3	Claypan	9
BsB:			
Bullock	VIs-3	Thin Claypan	10
Slickspots	VIIIs-3	---	---
CaD Cabbart	VIe-2	Shallow	10
CvB Cabbart Variant	VIs-1	Shallow	10
DeC:			
Delridge	VIe-3	Thin Upland	8
Cabbart	VIe-3	Shallow	10
EaA Eapa	IIIc-1	Silty	3

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
EaB Eapa	IIIe-1	Silty	3
EaC Eapa	IVe-1	Silty	3
EdB:			
Eapa	IIIe-1	Silty	3
Delridge	IVe-8	Thin Upland	8
EdC:			
Eapa	IVe-1	Silty	3
Delridge	IVe-8	Thin Upland	8
EgB:			
Eapa	IIIe-1	Silty	3
Grail	IIe-3	Silty	1
EgC:			
Eapa	IVe-1	Silty	3
Grail	IIIe-1	Silty	3
GaA Gerdrum	IVs-3	Claypan	9
Gc Glenberg	IIIe-4	Loamy Overflow	1
Gr Grail	IIc-3	Loamy Overflow	1
Hb Havre	IIIc-2	Loamy Overflow	1
Hc Havre	VIw-1	Loamy Overflow	1
He Heil	VIs-3	Closed Depression	10
HfB:			
Hisle	VIs-3	Thin Claypan	10
Slickspots	VIIIs-3	---	---
KyA Kyle	IVs-3	Clayey	4C
KyB Kyle	IVe-3	Clayey	4C
La Lardell	VIw-3	Saline Lowland	10
LaB Lawther	IVe-3	Clayey	4C
LbE Lismas	VIIe-5	Shallow Dense Clay.	10
LcA:			
Loburn	IVs-2	Claypan	9
Gerdrum	IVs-3	Claypan	9

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
Ld------------------ Lohmiller	IIIc-2	Loamy Terrace----	1
Lg------------------ Lohmiller	VIw-1	Loamy Overflow---	1
NaD:			
Nihill------------	VIs-4	Thin Upland------	10
Attewan-----------	VIs-4	Silty------------	6G
NuA----------------- Nunn	IIIc-1	Clayey-----------	3
NuB----------------- Nunn	IIIe-1	Clayey-----------	3
PbB:			
Parchin-----------	IVe-12	Claypan----------	9
Bullock-----------	VIs-3	Thin Claypan-----	10
PeB----------------- Pierre	IVe-3	Clayey-----------	4C
PeC----------------- Pierre	VIe-4	Clayey-----------	4C
PlE:			
Pierre------------	VIe-4	Clayey-----------	10
Lismas------------	VIIe-5	Shallow Dense Clay.	10
PsC:			
Pierre------------	VIe-4	Clayey-----------	4C
Samsil------------	VIe-12	Shallow Clay-----	10
RoE:			
Rock outcrop------	VIIIs-1	---	---
Cabbart-----------	VIIe-4	Shallow----------	10
Bullock-----------	VIIe-7	Thin Claypan-----	10
SaD----------------- Samsil	VIe-12	Shallow Clay-----	10
SbE:			
Samsil------------	VIIe-5	Shallow Clay-----	10
Rock outcrop------	VIIIs-1	---	---
SdA----------------- Satanta	IIIc-1	Silty------------	3
SdB----------------- Satanta	IIIe-1	Silty------------	3
St------------------ Stetter	IVs-3	Clayey Overflow--	4C
SwA----------------- Swanboy	VIs-6	Dense Clay-------	10
SyA:			
Swanboy-----------	VIs-6	Dense Clay-------	10
Slickspots--------	VIIIs-3	---	---

See footnote at end of table.

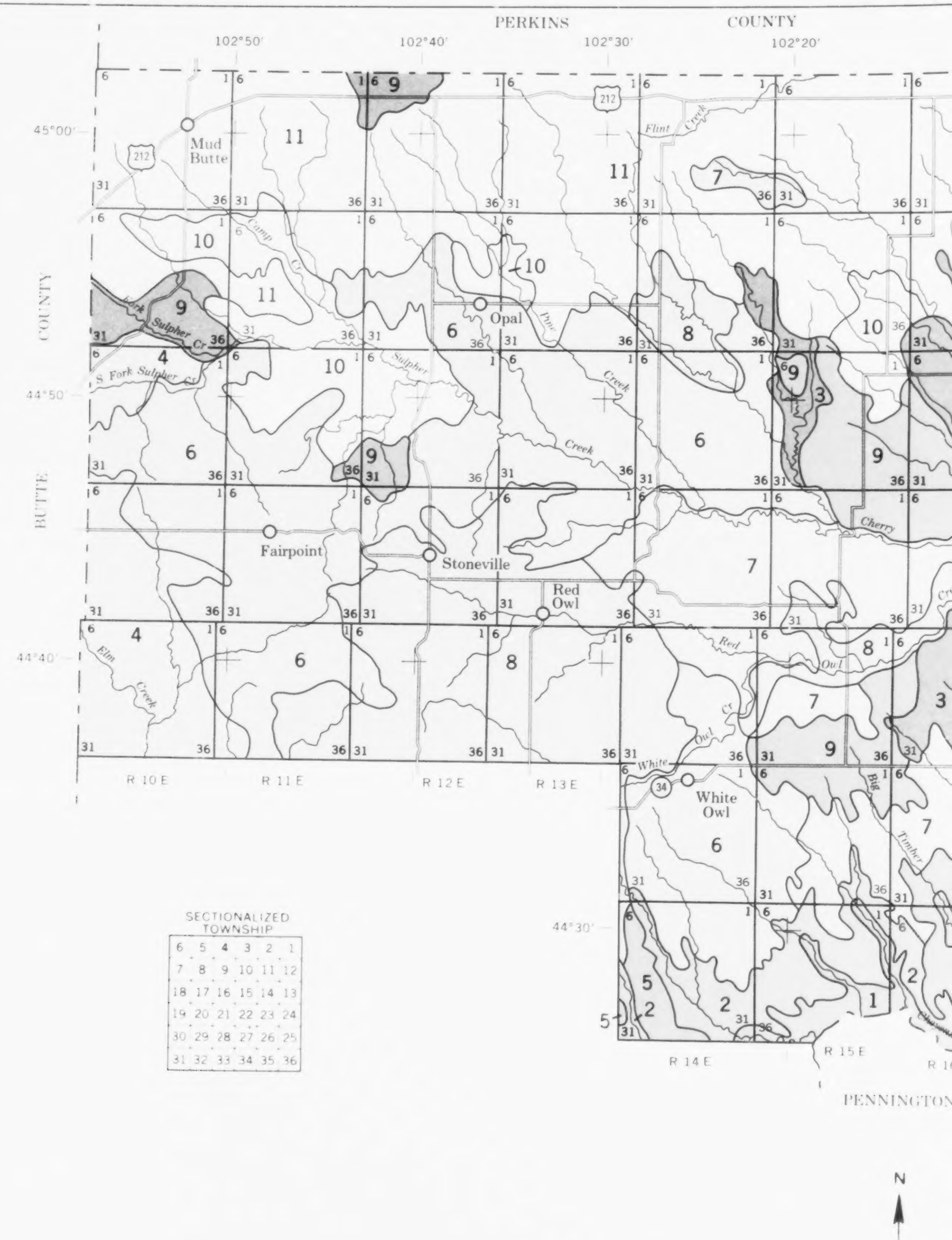
INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*
TdB:			
Tanna	IIIe-1	Clayey	4L
Delridge	IVe-3	Thin Upland	8
TdC:			
Tanna	IVe-1	Clayey	4L
Delridge	IVe-1	Thin Upland	8
TsB:			
Tanna	IIIe-1	Clayey	4L
Savo	IIIe-1	Silty	3
TsC:			
Tanna	IVe-1	Clayey	4L
Savo	IVe-1	Silty	3
TwC:			
Twilight	IVe-7	Sandy	6R
Marmarth	IVe-1	Silty	6R
Parchin	IVe-12	Claypan	9
WhC Winler	VIs-6	Dense Clay	10
WlC:			
Winler	VIs-6	Dense Clay	10
Lismas	VIe-12	Shallow Dense Clay.	10
YaC Yawdim	VIe-12	Shallow	10

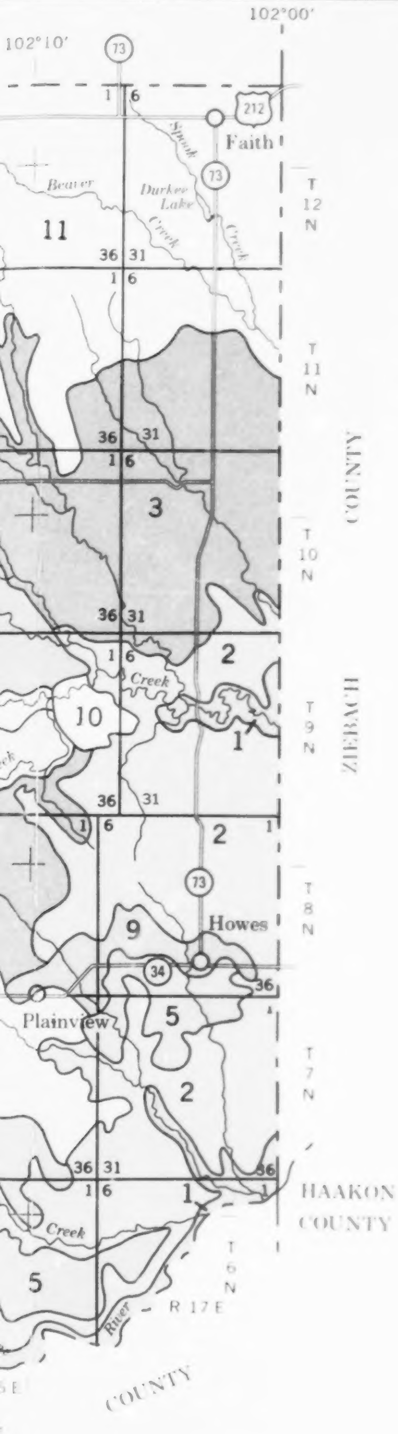
* Soils in windbreak suitability group 10 are unsuited to windbreaks.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1985 O - 477-206 QL 3

2°
P
E


PERKINS COUNTY
BUTTE COUNTY
PENNINGTON
102°50′
102°40′
102°30′
102°20′
45°00′
44°50′
44°40′
44°30′
Mud Butte
Opal
Fairpoint
Stoneville
Red Owl
White Owl
212
34
Flint Creek
Camp Cr
Fork Sulpher Cr
S Fork Sulpher Cr
Sulpher Creek
Pine Creek
Elm Creek
Cherry
Red Owl Cr
White
Big Timber
R 10 E
R 11 E
R 12 E
R 13 E
R 14 E
R 15 E
1
2
3
4
5
6
7
8
9
10
11
SECTIONALIZED TOWNSHIP
6 5 4 3 2 1
7 8 9 10 11 12
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



LEGEND*

NEARLY LEVEL, LOAMY AND SILTY SOILS ON FLOOD PLAINS

1 Lohmiller-Glenberg association: Deep, well drained, nearly level, silty and loamy soils on flood plains

NEARLY LEVEL TO STEEP, CLAYEY SOILS ON FOOT SLOPES AND UPLANDS

2 Samsil association: Shallow, well drained, moderately sloping to steep, clayey soils on uplands

3 Lawther-Abor association: Deep and moderately deep, well drained, gently sloping and moderately sloping, clayey soils on uplands

4 Lismas-Pierre-Swanboy association: Shallow to deep, well drained, nearly level to steep, clayey soils on uplands and foot slopes

NEARLY LEVEL TO STEEP, LOAMY AND SILTY SOILS ON UPLANDS AND TERRACES

5 Nunn-Satanta association: Deep, well drained, nearly level and gently sloping, loamy soils on terraces

6 Assinniboine-Blackhall-Twilight association: Deep to shallow, well drained, gently sloping to steep, loamy soils on uplands

7 Cabbart-Delridge association: Shallow and moderately deep, well drained, gently sloping to steep, loamy soils on uplands

8 Eapa-Delridge association: Deep and moderately deep, well drained, nearly level to moderately sloping, loamy soils on uplands

9 Eapa-Tanna-Savo association: Deep and moderately deep, well drained, nearly level to moderately sloping, loamy and silty soils on uplands and terraces

NEARLY LEVEL TO MODERATELY SLOPING, LOAMY AND SILTY, SODIUM AFFECTED SOILS ON UPLANDS AND TERRACES

10 Gerdrum-Absher-Loburn association: Deep, well drained, nearly level and gently sloping, sodium affected, loamy and silty soils on uplands and terraces

11 Bullock-Parchin association: Moderately deep, well drained, nearly level to moderately sloping, sodium affected, loamy soils on uplands

*The texture terms in the descriptive headings refer to the surface layer of the major soils in each association.

Compiled 1983

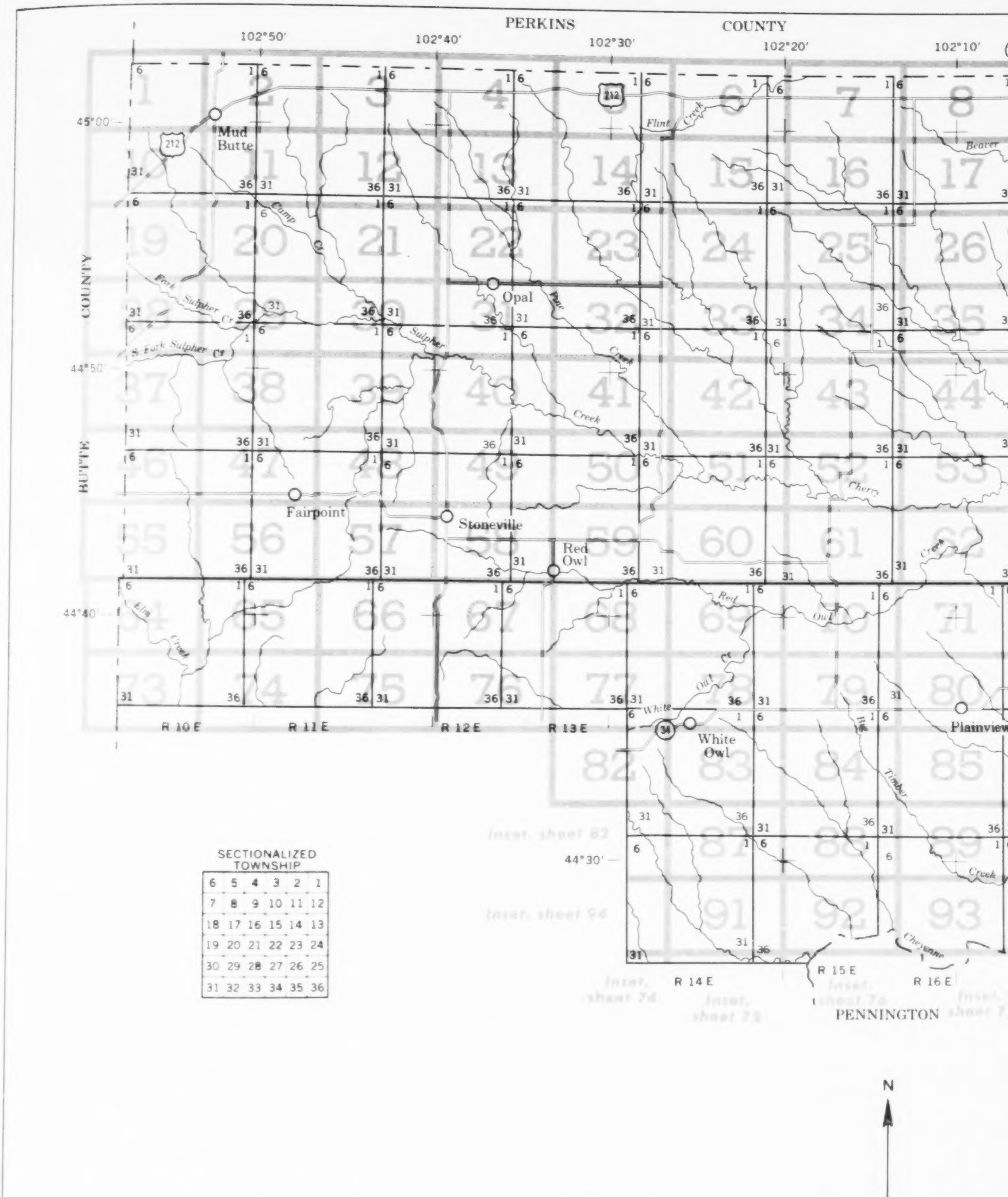
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

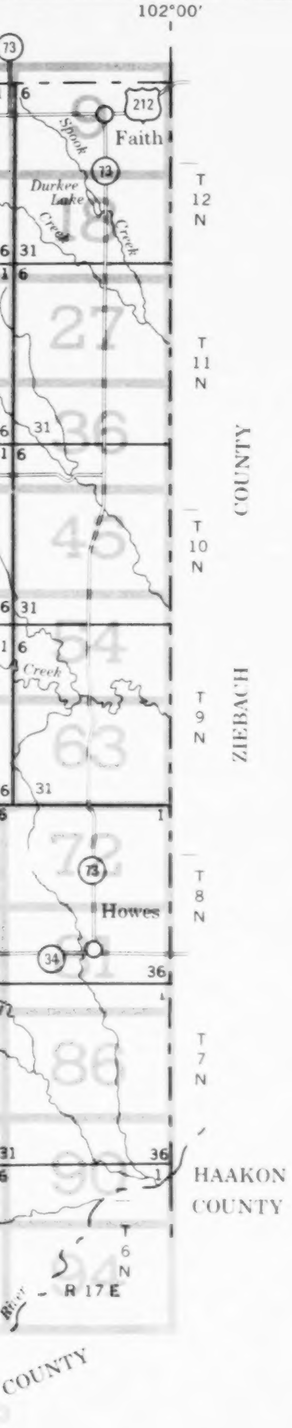
GENERAL SOIL MAP
MEADE COUNTY, NORTHERN PART
SOUTH DAKOTA

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

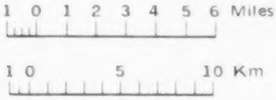
1 0 5 10 Km


PERKINS COUNTY
BUTTE COUNTY
PENNINGTON
102°50′
102°40′
102°30′
102°20′
102°10′
45°00′
44°50′
44°40′
44°30′
Mud Butte
Opal
Fairpoint
Stoneville
Red Owl
White Owl
Plainview
212
34
Flint Creek
Beaver
Camp Cr
Fork Sulpher Cr
S Fork Sulpher Cr
Sulpher
Pine Creek
Creek
Cherry
Creek
Elm Creek
Red Owl
Owl Cr
White
Timber
Creek
Cheyenne
R 10 E
R 11 E
R 12 E
R 13 E
R 14 E
R 15 E
R 16 E
Inset, sheet 82
Inset, sheet 94
Inset, sheet 74
Inset, sheet 75
Inset, sheet 76
Inset, sheet 7
SECTIONALIZED TOWNSHIP
6 5 4 3 2 1
7 8 9 10 11 12
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
N


102°00'
73
212
Faith
Spook
Durkee Lake
Creek
Creek
9
18
27
36
45
54
63
72
81
86
90
94
T 12 N
T 11 N
T 10 N
T 9 N
T 8 N
T 7 N
T 6 N
ZIEBACH COUNTY
Howes
34
HAAKON COUNTY
R 17 E
COUNTY
6
31
1

INDEX TO MAP SHEETS
MEADE COUNTY, NORTHERN PART
SOUTH DAKOTA

Scale 1:380,160


1 0 1 2 3 4 5 6 Miles
1 0 5 10 Km

SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils.

SYMBOL	NAME
AbB	Abor silty clay, 2 to 6 percent slopes
AbC	Abor silty clay, 6 to 9 percent slopes
AiB	Absher-Slickspots complex, 2 to 6 percent slopes
AsB	Assinniboine fine sandy loam, 2 to 6 percent slopes
AsC	Assinniboine fine sandy loam, 6 to 9 percent slopes
AtC	Assinniboine-Twilight fine sandy loams, 6 to 9 percent slopes
Ba	Bankard loamy fine sand
Bb	Bankard gravelly loamy sand
BlE	Blackhall-Rock outcrop complex, 15 to 40 percent slopes
BmE	Blackhall-Twilight fine sandy loams, 9 to 40 percent slopes
BoE	Bullock-Lardell-Blackhall complex, 2 to 40 percent slopes
BpB	Bullock-Parchin fine sandy loams, 0 to 4 percent slopes
BsB	Bullock-Slickspots complex, 0 to 4 percent slopes
CaD	Cabbart loam, 9 to 40 percent slopes
CvB	Cabbart Variant loam, 2 to 6 percent slopes
DeC	Delridge-Cabbart loams, 6 to 15 percent slopes
EaA	Eapa loam, 0 to 2 percent slopes
EaB	Eapa loam, 2 to 6 percent slopes
EaC	Eapa loam, 6 to 9 percent slopes
EdB	Eapa-Delridge loams, 2 to 6 percent slopes
EdC	Eapa-Delridge loams, 6 to 9 percent slopes
EgB	Eapa-Grail complex, 2 to 6 percent slopes
EgC	Eapa-Grail complex, 6 to 9 percent slopes
GaA	Gerdrum loam, 0 to 4 percent slopes
Gc	Glenberg fine sandy loam
Gr	Grail silt loam
Hb	Havre loam
Hc	Havre loam, channeled
He	Heil silty clay loam
HfB	Hisle-Slickspots complex, 0 to 4 percent slopes
KyA	Kyle clay, 0 to 2 percent slopes
KyB	Kyle clay, 2 to 6 percent slopes
La	Lardell fine sandy loam
LaB	Lawther silty clay, 2 to 6 percent slopes
LbE	Lismas clay, 15 to 40 percent slopes
LcA	Loburn-Gerdrum complex, 0 to 3 percent slopes
Ld	Lohmiller silty clay loam
Lg	Lohmiller silty clay loam, channeled
NaD	Nihill-Attewan complex, 4 to 20 percent slopes
NuA	Nunn clay loam, 0 to 2 percent slopes
NuB	Nunn clay loam, 2 to 6 percent slopes
PbB	Parchin-Bullock fine sandy loams, 2 to 6 percent slopes
PeB	Pierre clay, 2 to 6 percent slopes
PeC	Pierre clay, 6 to 15 percent slopes
PlE	Pierre-Lismas clays, 15 to 40 percent slopes
PsC	Pierre-Samsil clays, 6 to 15 percent slopes
RoE	Rock outcrop-Cabbart-Bullock complex, 15 to 40 percent slopes
SaD	Samsil clay, 6 to 25 percent slopes
SbE	Samsil-Rock outcrop complex, 15 to 40 percent slopes
SdA	Satanta loam, 0 to 2 percent slopes
SdB	Satanta loam, 2 to 6 percent slopes
St	Stetter clay
SwA	Swanboy clay
SyA	Swanboy-Slickspots complex, 0 to 2 percent slopes
TdB	Tanna-Delridge complex, 2 to 6 percent slopes
TdC	Tanna-Delridge complex, 6 to 9 percent slopes
TsB	Tanna-Savo complex, 2 to 6 percent slopes
TsC	Tanna-Savo complex, 6 to 9 percent slopes
TwC	Twilight-Marmarth-Parchin fine sandy loams, 4 to 9 percent slopes
WhC	Winler clay, 2 to 9 percent slopes
WlC	Winler-Lismas clays, 6 to 15 percent slopes
YaC	Yawdim silty clay loam, 6 to 9 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Federal
- State

RAILROAD

DAMS

- Medium or small

PITS

- Gravel pit

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas) •
- Church •
- School

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end

LAKES, PONDS AND RESERVOIRS

- Perennial — water w

MISCELLANEOUS WATER FEATURES

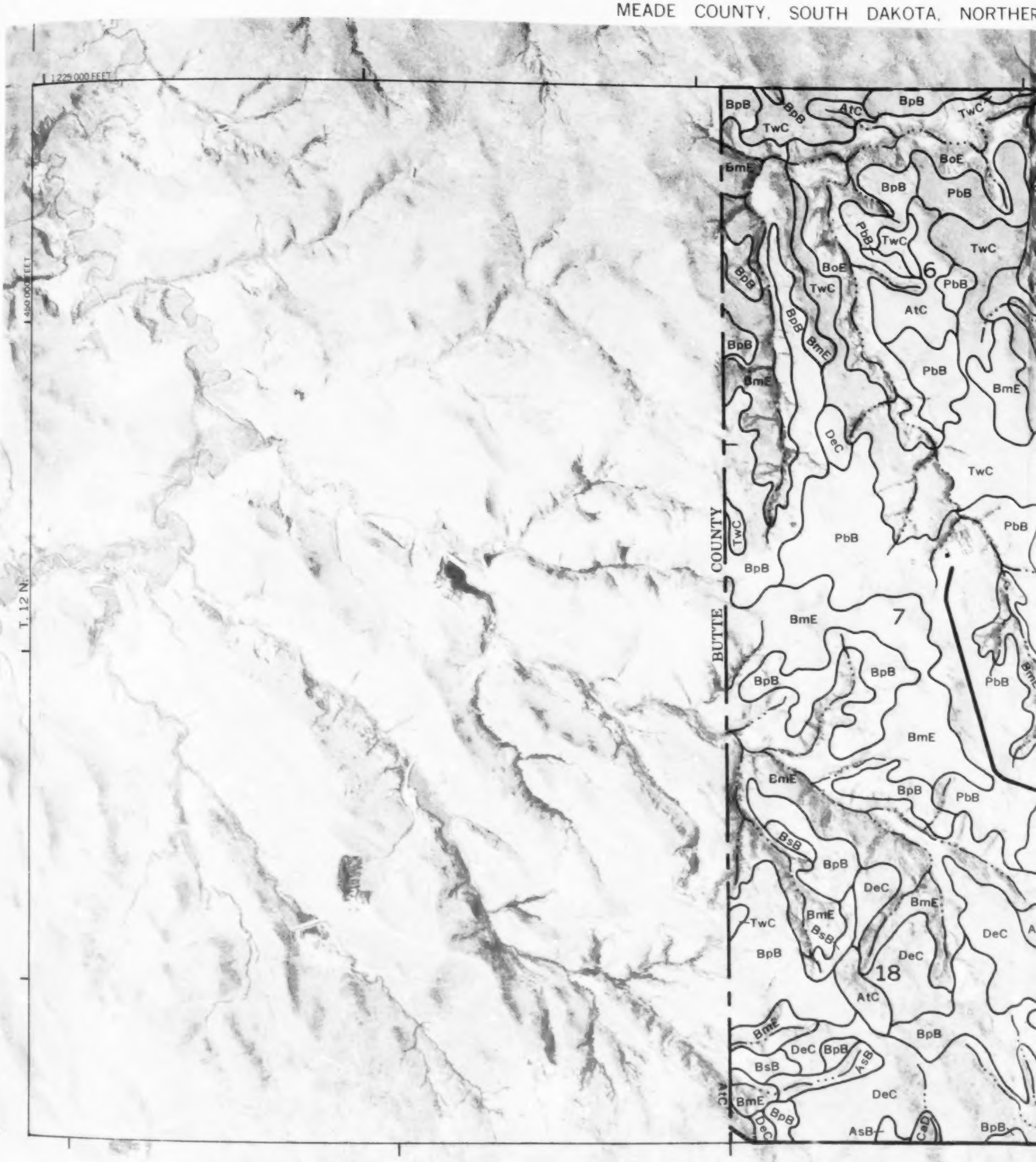
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — SoE Hb

MISCELLANEOUS

- Gravelly spot
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Stony spot, very stony spot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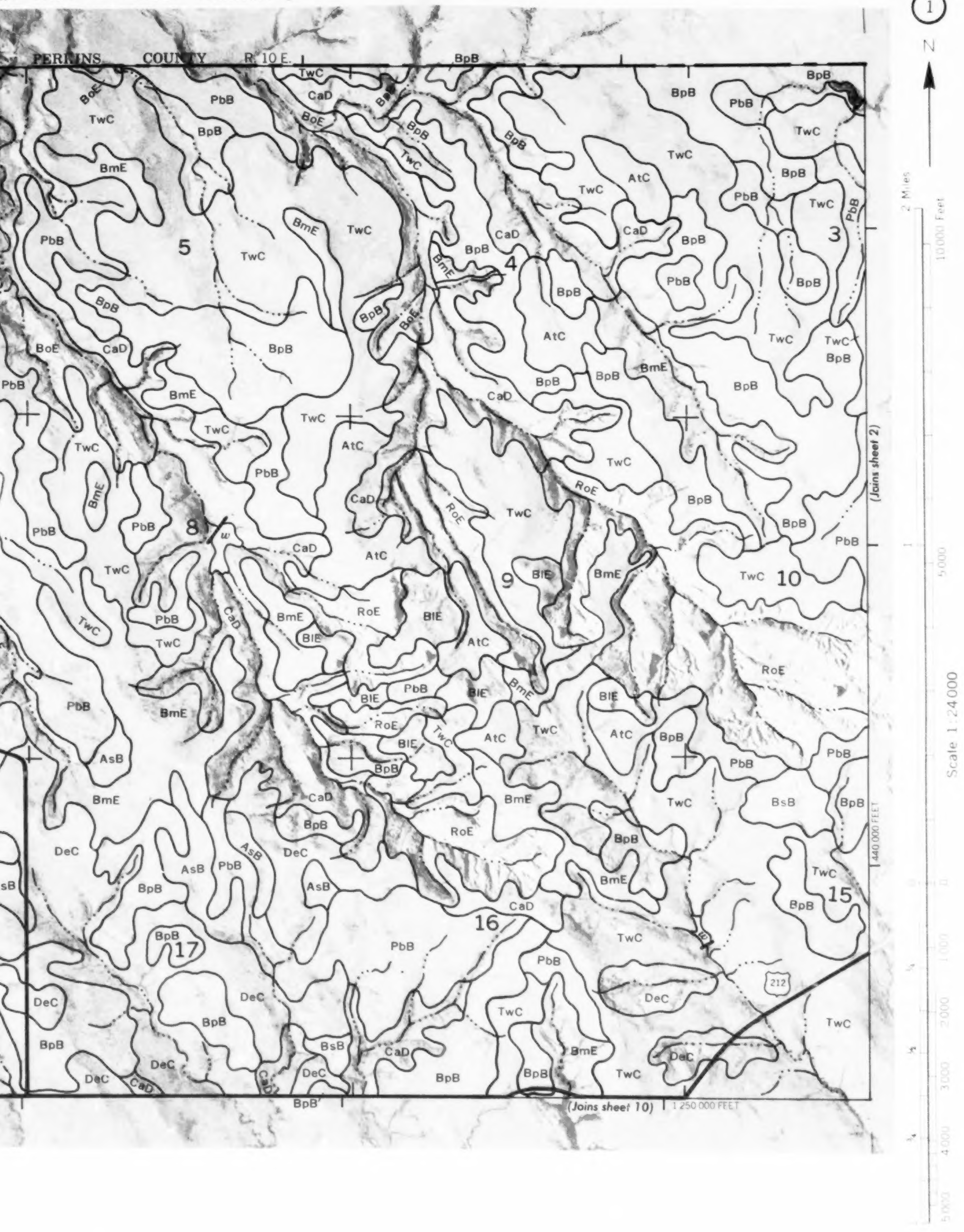
T. 12 N.
BUTTE COUNTY
BpB
BpB
AtC
BpB
TwC
TwC
BmE
BoE
BpB
PbB
PbB
TwC
TwC
BpB
BoE
TwC
6
PbB
AtC
BpB
BpB
BmE
PbB
BmE
BmE
DeC
TwC
TwC
PbB
PbB
BpB
BmE
7
BpB
BpB
PbB
BmE
BmE
BpB
PbB
BsB
BpB
DeC
BmE
TwC
BmE
BsB
BpB
DeC
DeC
18
AtC
BpB
BmE
DeC
BpB
AsB
BsB
DeC
AtC
BmE
BpB
DeC
AsB
CaD
BpB

RN PART — SHEET NUMBER 1

①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5000
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1000
2000
3000
4000
5000
212
3
4
5
8
9
10
15
16
17
w
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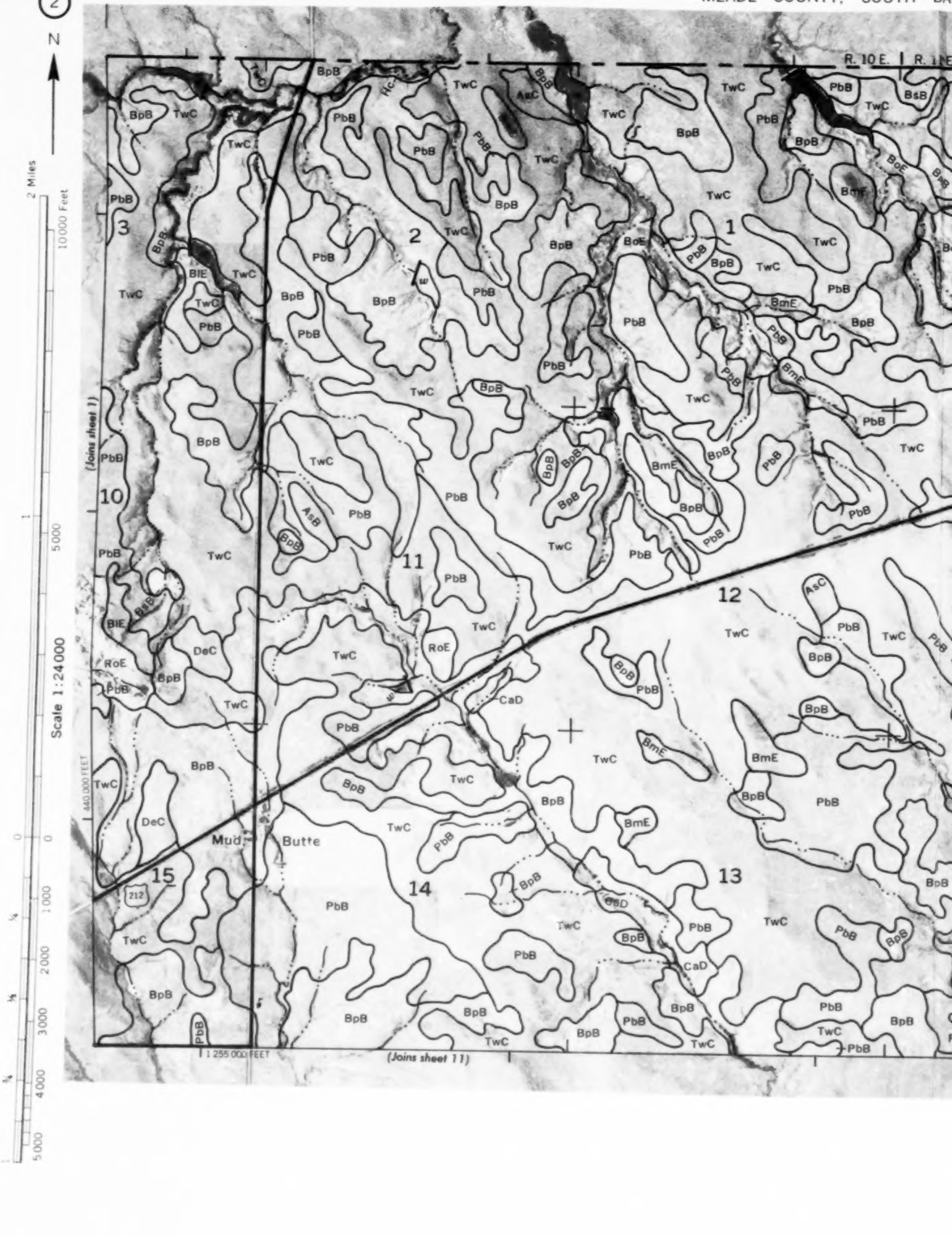
PbB
TwC
CaD
BoE
BmE
AtC
RoE
BlE
AsB
DeC
BsB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2 Miles
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0
¼
½
¾
1
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5000
0
1000
2000
3000
4000
5000
R. 10 E.
R. 11 E.
(Joins sheet 1)
(Joins sheet 11)
440 000 FEET
1 255 000 FEET
1
2
3
10
11
12
13
14
15
Mud
Butte
212
w
BpB
PbB
TwC
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BmF
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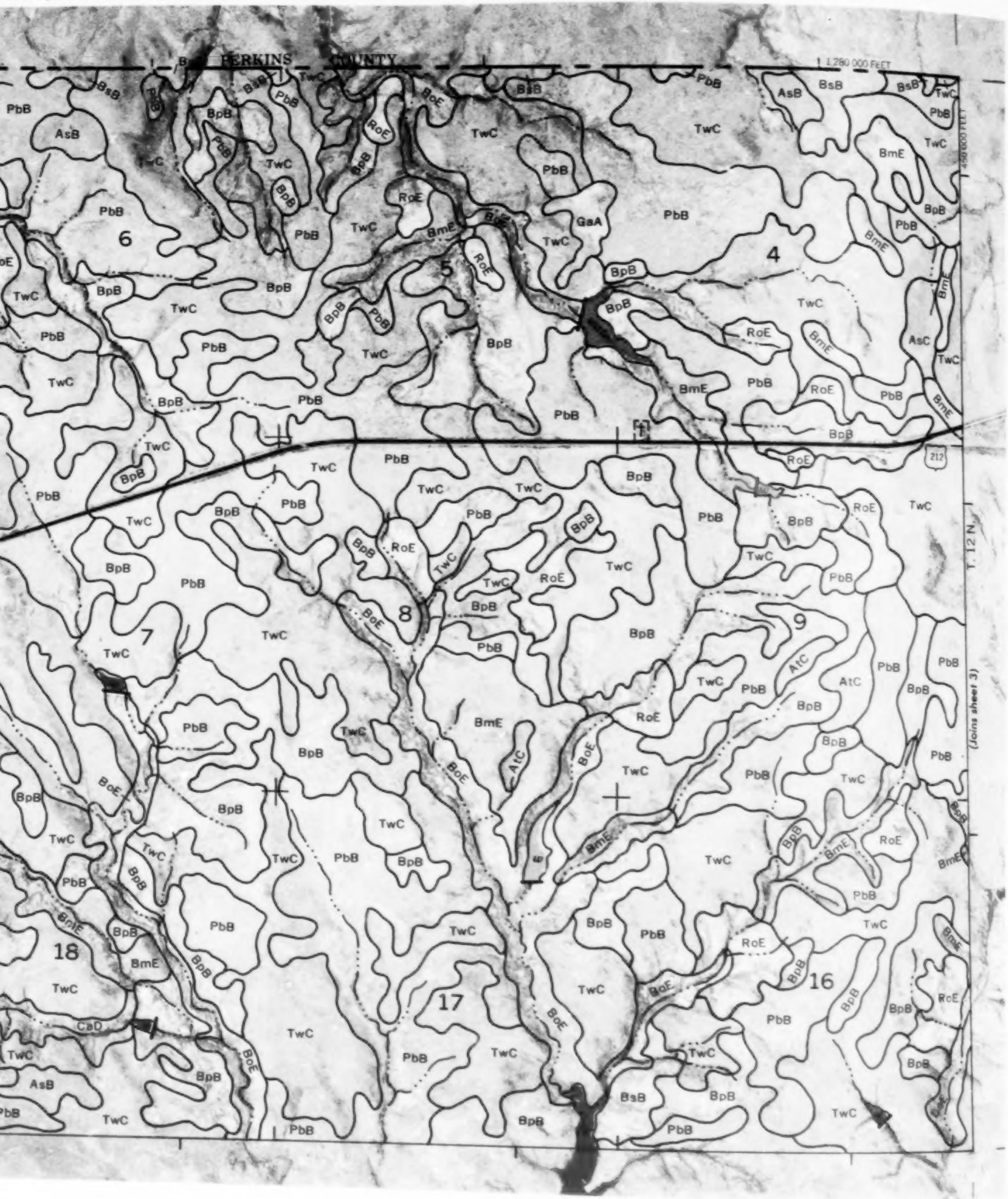
RoE
DeC
CaD
Hc

KOTA, NORTHERN PART — SHEET NUMBER 2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PbB
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BsB
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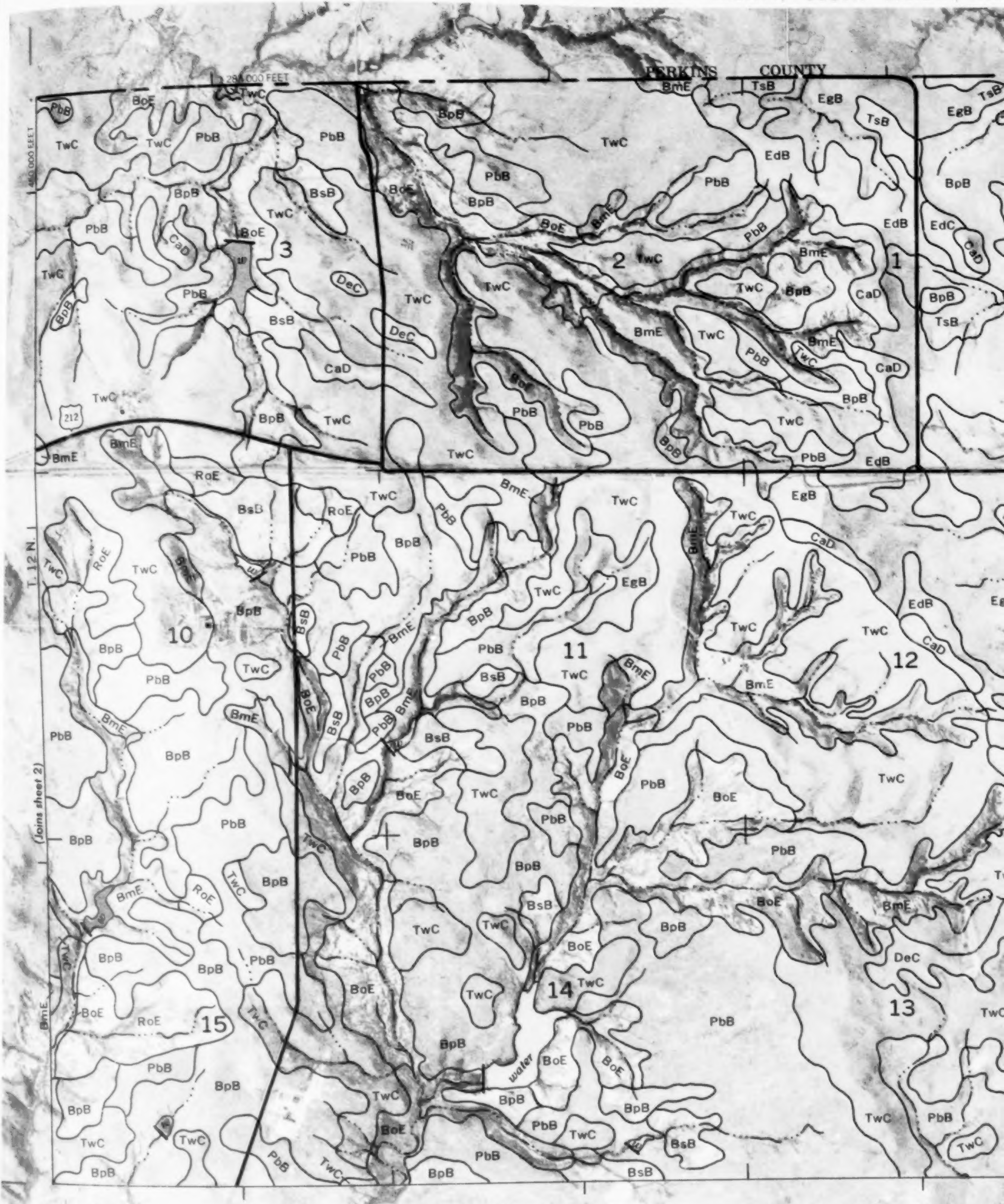
TwC
RoE
BmE
BoE
GaA
AsC
AtC
CaD

MEADE COUNTY, SOUTH DAKOTA, NO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2
3
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11
12
13
14
15
212
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BoE
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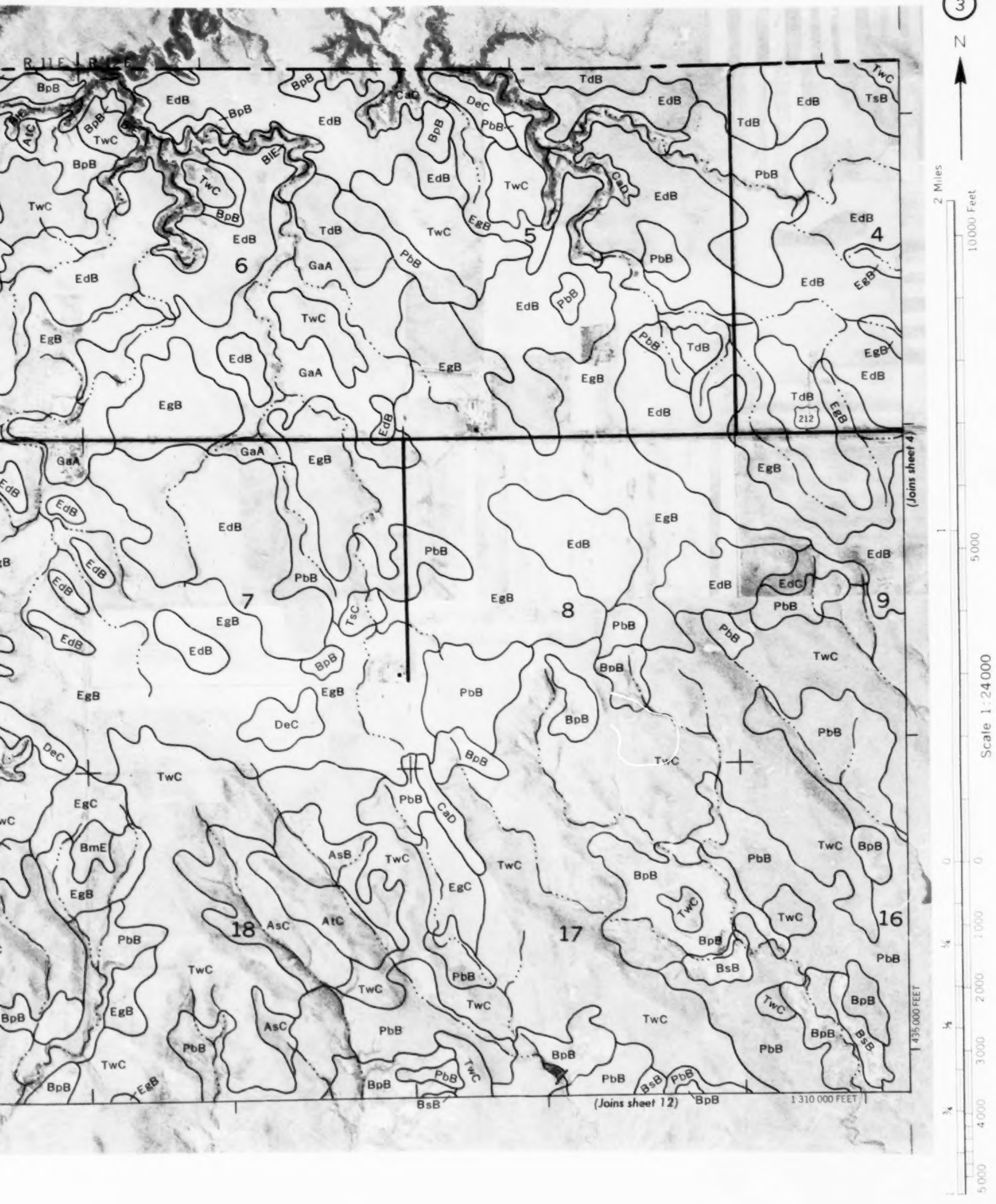
BsB
BmE
CaD
DeC
EgB
TsB
EdB
EdC
RoE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BpB
EdB
BpB
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DeC
TdB
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EdB
PbB
BpB
BpB
TdB
BpB
TwC
BlE
EdB
PbB
CaD
EdB
TwC
BpB
TwC
EgB
EdB
4
EdB
TdB
TwC
5
PbB
6
EdB
GaA
PbB
EdB
PbB
EdB
EgB
TwC
EgB
PbB
TdB
EgB
EdB
GaA
EgB
EgB
EdB
EgB
EdB
TdB
212
EgB
EdB
GaA
EgB
GaA
EdB
EgB
(Joins sheet 4)
EdB
EdB
EdB
EgB
EdB
EdB
PbB
EdB
EdB
EdB
EdC
EdB
PbB
PbB
7
EgB
8
9
EdB
TsC
PbB
PbB
TwC
EdB
BpB
BpB
EgB
EgB
PbB
DeC
BpB
PbB
DeC
BpB
TwC
TwC
EgC
PbB
CaD
wC
BmE
AsB
TwC
TwC
BpB
PbB
EgC
TwC
EgB
BpB
18
AsC
AtC
17
TwC
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PbB
BpB
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PbB
PbB
TwC
TwC
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BpB
TwC
AsC
PbB
TwC
BpB
BpB
PbB
BsB
TwC
PbB
PbB
BpB
EgB
BpB
PbB
TwC
PbB
BsB
PbB
BpB
BsB
(Joins sheet 12)
BpB
1 310 000 FEET
435 000 FEET
N
2 Miles
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½
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¼
½
¾
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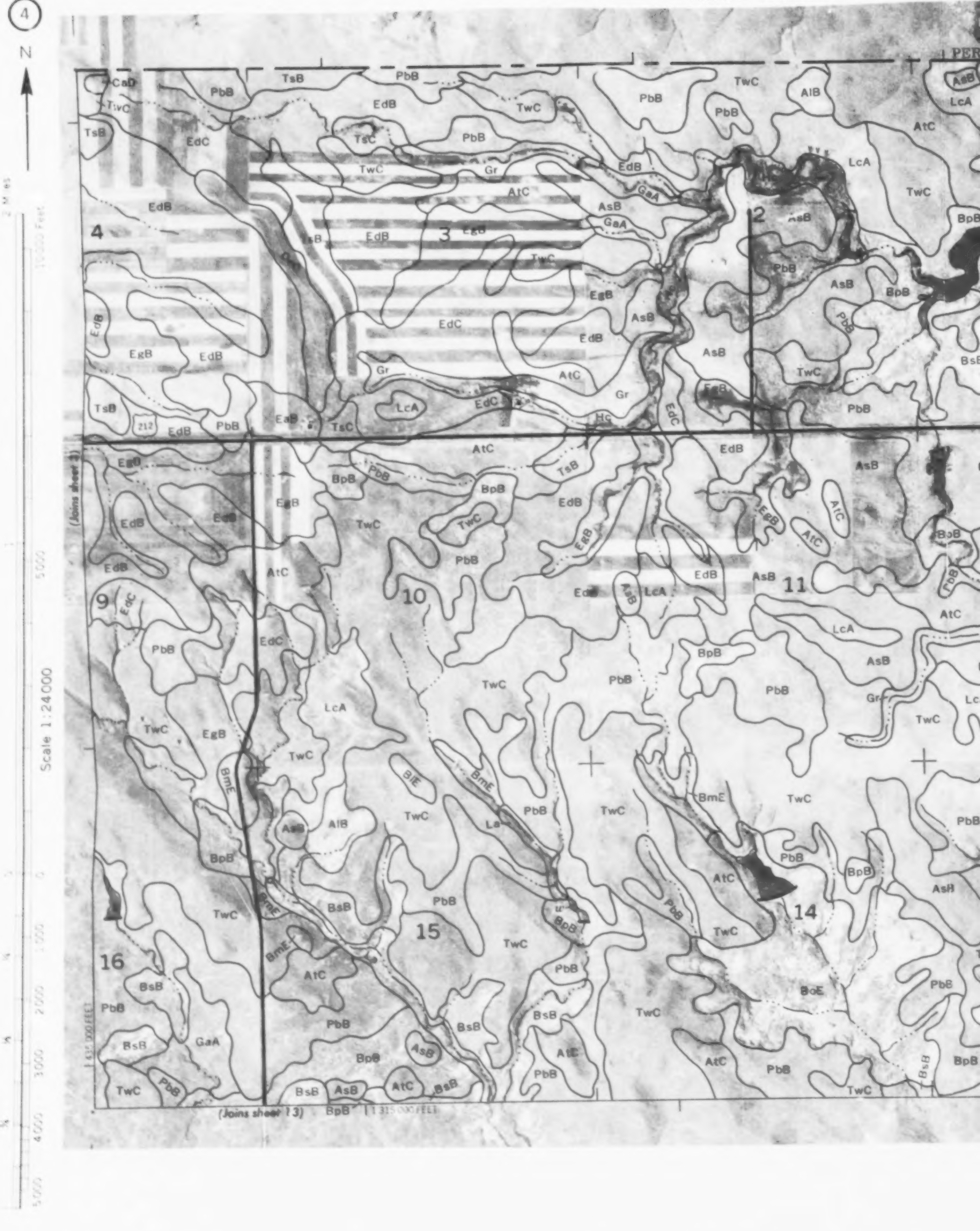
1000
2000
3000
4000
5000
Scale 1:24000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Scale 1:24000
2 Miles
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½
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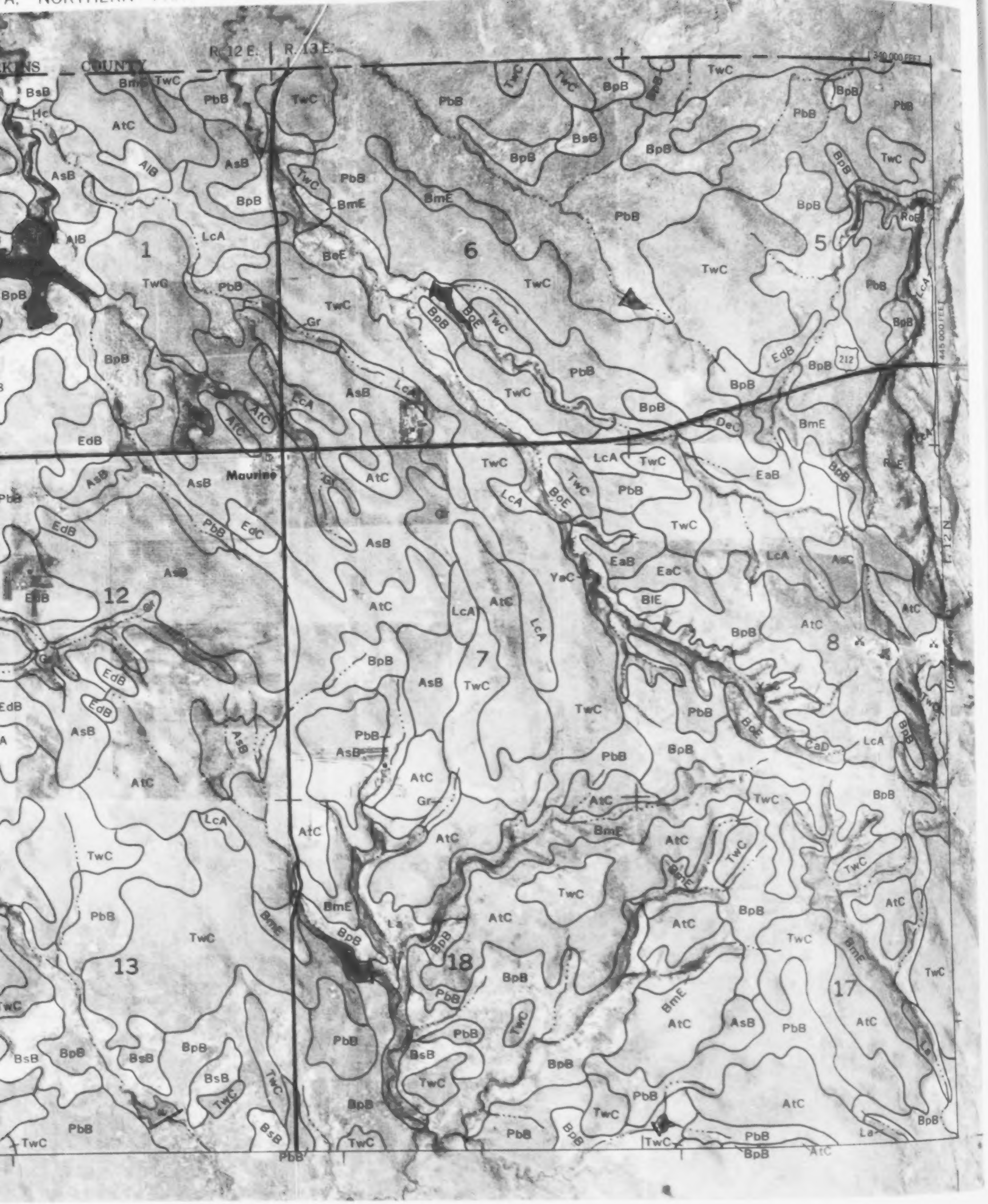
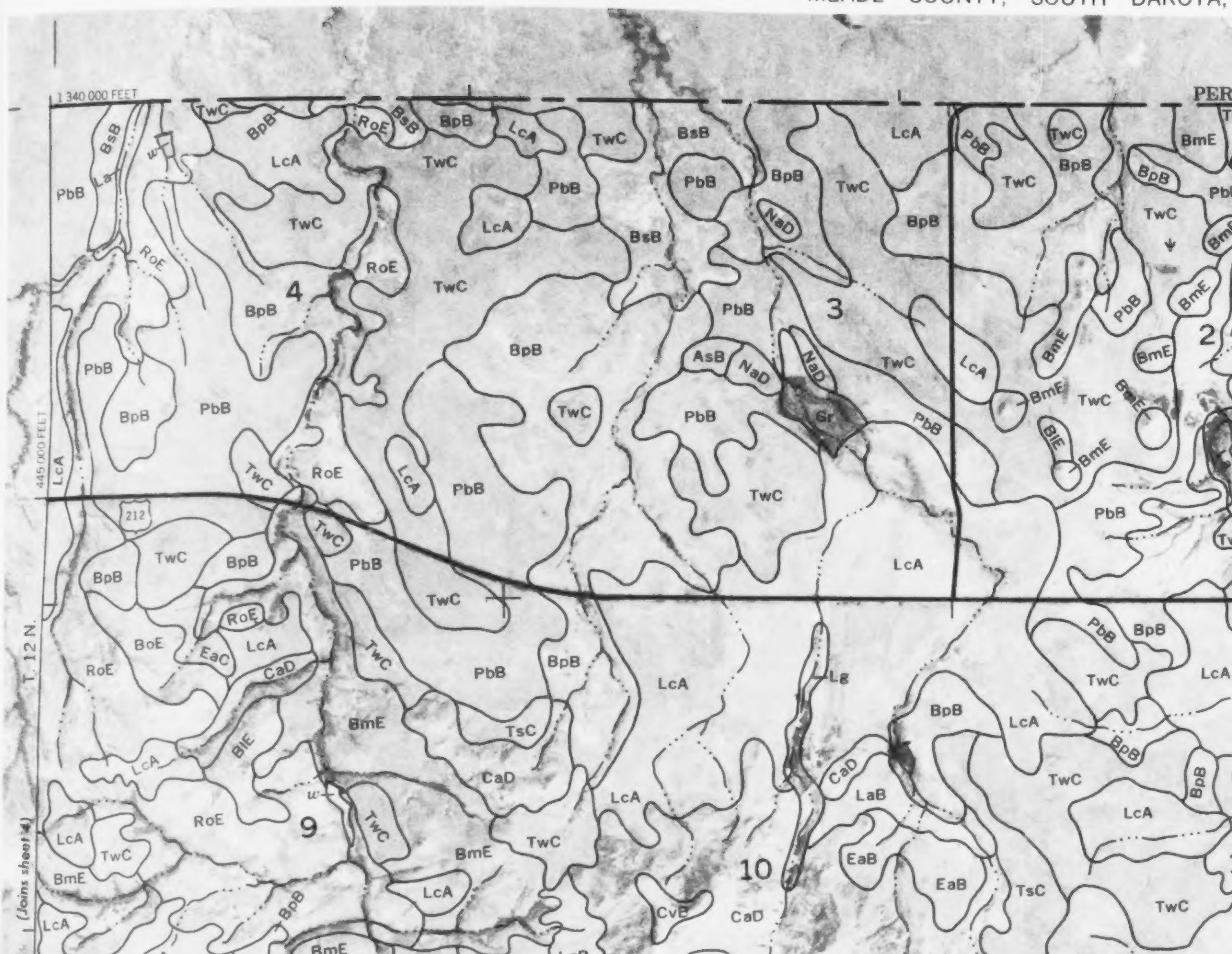
1000
2000
3000
4000
5000
(Joins sheet 3)
(Joins sheet 13)
435 000 FEET
1 315 000 FEET
PER
212
2
3
4
9
10
11
14
15
16
CaD
TwC
TsB
PbB
EdB
EdC
TsC
Gr
AtC
AsB
GaA
AlB
LcA
BpB
EgB
EaB
Hc
BsB
LaB
BmE
BlE
La
BoE
AsH
TwC
AtC
PbB
AsB
BsB
AtC
BsB
TwC
PbB
BpB
BsB

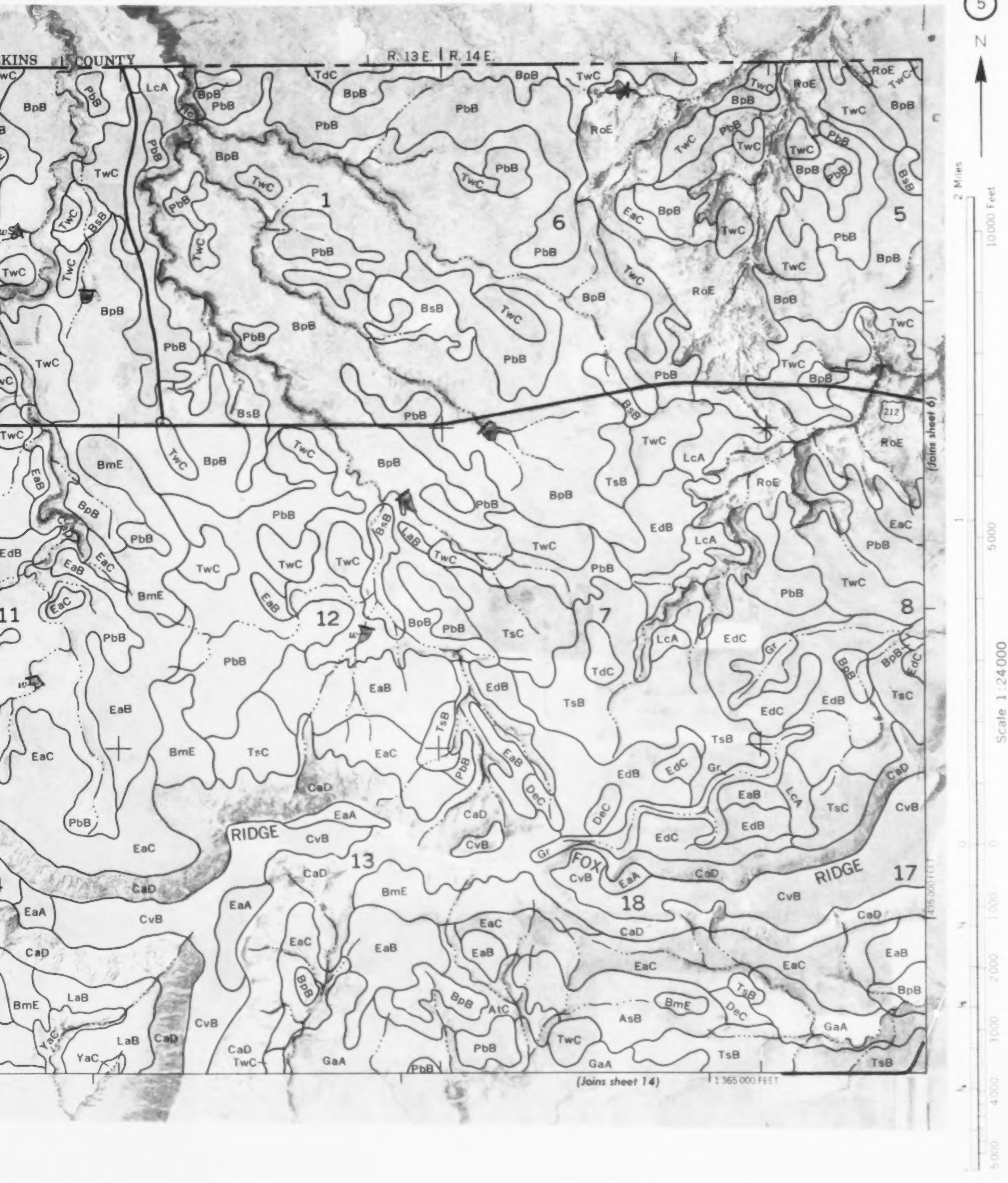
TA, NORTHERN PART — SHEET NUMBER 4

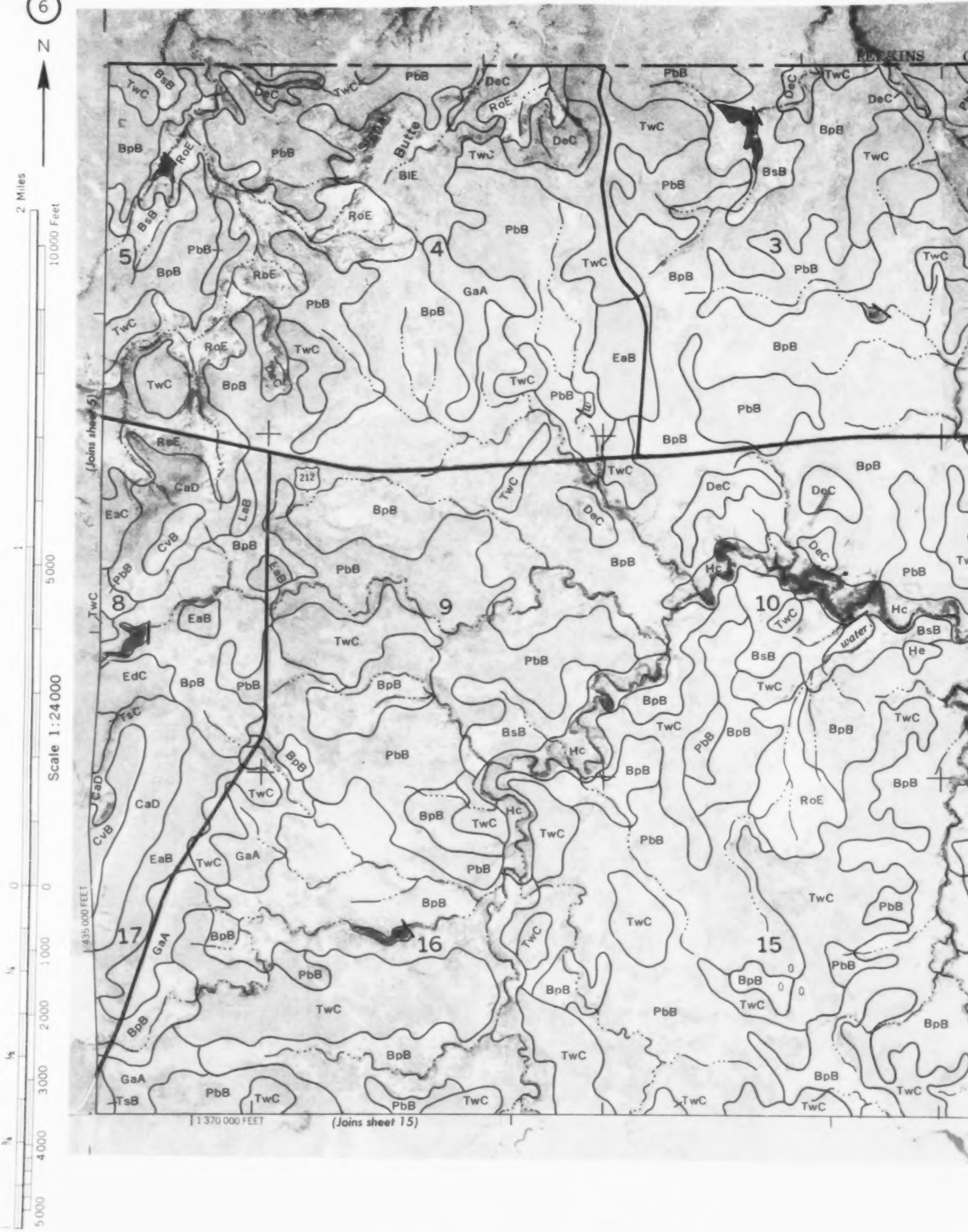


R. 12 E.
R. 13 E.
KINS COUNTY
340 000 FEET
445 000 FEET
T. 12 N.
212
Maurine
1
5
6
7
8
12
13
17
18
BsB
BmE
TwC
PbB
TwC
PbB
TwC
TwC
BpB
BpB
TwC
BpB
PbB
PbB
Hc
AtC
AsB
AlB
AsB
BpB
BsB
BpB
BpB
BpB
TwC
TwC
PbB
BmE
BmE
PbB
BpB
RoE
AlB
LcA
TwC
BoE
TwC
PbB
BpB
PbB
BpB
TwG
PbB
Gr
TwC
BpB
BoE
TwC
LcA
BpB
AsB
LcA
LcA
PbB
EdB
BpB
AtC
AtC
TwC
BpB
DeC
BmE
EdB
AsB
AsB
TwC
LcA
TwC
EaB
BoB
RoE
PbB
Gr
AtC
LcA
BoE
TwC
PbB
TwC
EdB
PbB
EdC
Gr
AsB
EaB
EaC
LcA
AsC
YaC
AsB
EdB
12
AtC
LcA
AtC
LcA
BlE
AtC
AtC
BpB
BpB
AsB
TwC
EdB
EdB
EdB
AsB
TwC
PbB
BoE
CaD
LcA
BpB
TwC
AsB
PbB
AsB
AtC
PbB
BpB
AtC
Gr
AtC
TwC
BpB
LcA
AtC
AtC
BmE
AtC
TwC
TwC
TwC
AtC
TwC
BmE
BmE
BmE
La
AtC
AtC
BpB
TwC
PbB
TwC
BpB
BpB
BmE
PbB
BpB
BpB
TwC
BmE
AtC
AsB
PbB
AtC
TwC
PbB
PbB
BsB
BpB
BsB
BpB
BsB
TwC
TwC
BsB
TwC
BpB
BpB
PbB
La
PbB
TwC
BsB
TwC
BpB
PbB
BpB
TwC
PbB
AtC
BpB
La
PbB
TwC
PbB
TwC
PbB
BpB
AtC

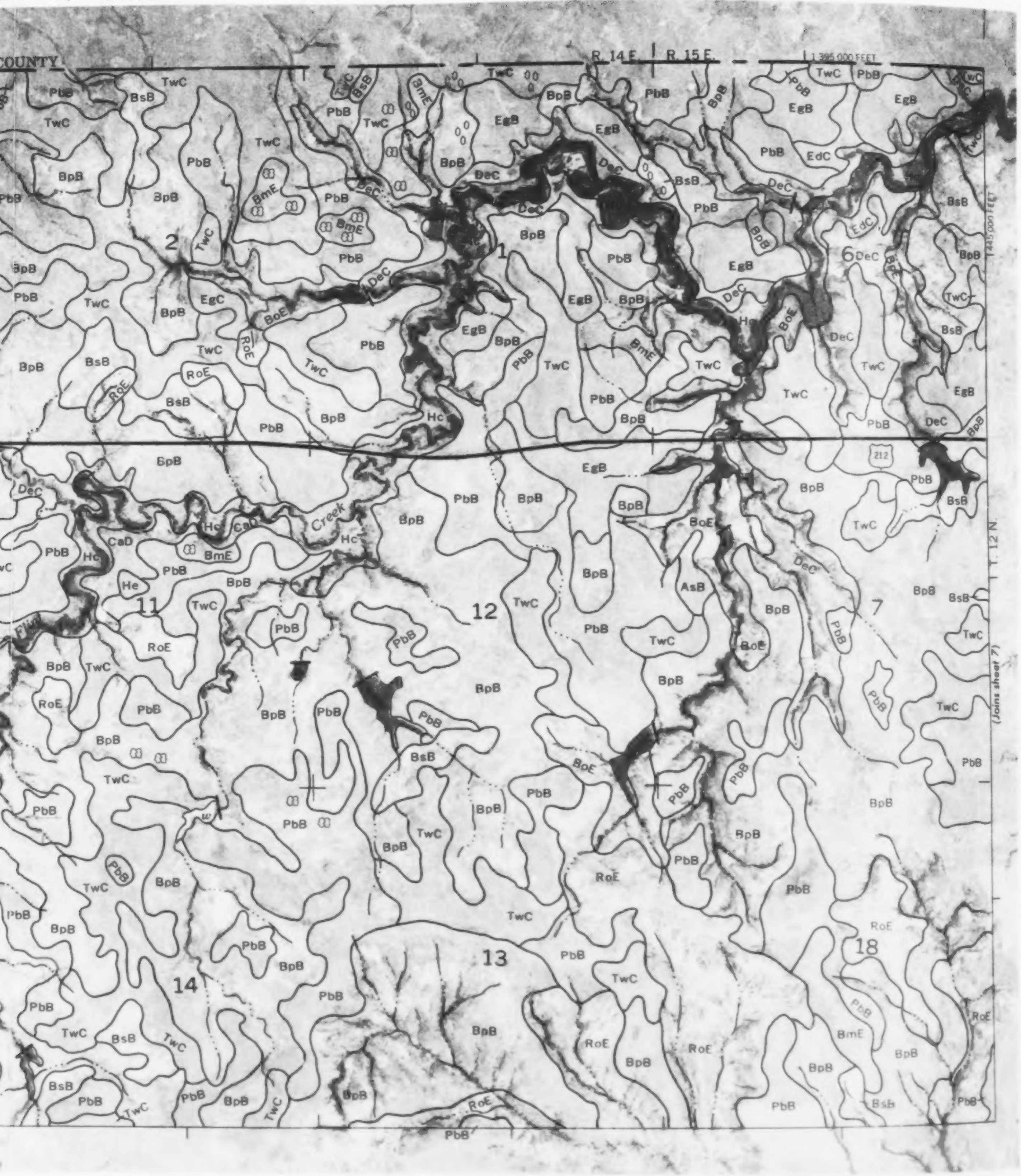


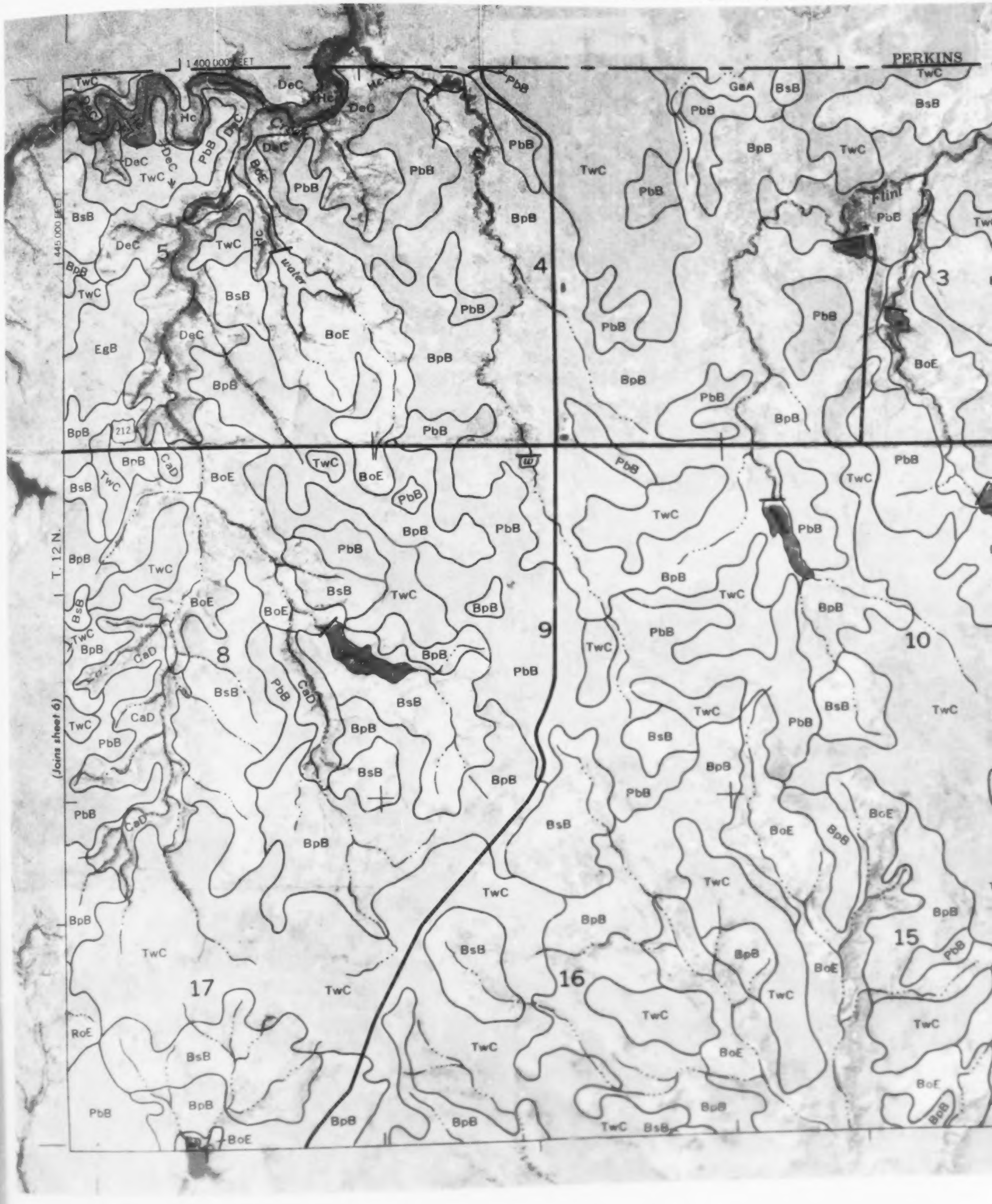
1 340 000 FEET
445 000 FEET
T. 12 N.
(Joins sheet 4)
212
PER
TwC
BpB
RoE
BsB
BpB
LcA
TwC
BsB
PbB
BpB
TwC
LcA
BpB
PbB
BsB
La
PbB
LcA
TwC
LcA
PbB
BsB
NaD
RoE
TwC
TwC
RoE
4
BpB
BpB
PbB
3
TwC
BpB
BmE
PbB
BmE
2
PbB
BpB
AsB
NaD
NaD
Gr
LcA
BmE
TwC
BlE
BmE
PbB
PbB
TwC
PbB
LcA
TwC
RoE
LcA
PbB
TwC
BpB
TwC
BpB
TwC
PbB
LcA
TwC
RoE
BoE
EaC
LcA
CaD
TwC
PbB
BpB
LcA
PbB
BpB
LcA
TwC
RoE
Lg
BpB
LcA
BlE
BmE
TsC
CaD
LaB
BpB
TwC
LcA
LcA
LcA
RoE
9
TwC
CaD
LcA
TwC
BmE
BmE
TwC
10
EaB
EaB
TsC
TwC
LcA
BpB
LcA
CvB
CaD
TwC
BmE
BpB
TwC
LaB
BlE
CaD
PbB
TwC
BpB
AsB
LcA
RoE
TwC
BpB
LaB
LcA
BmE
AtC
CvB
BmE
TsC
BpB
TwC
TwC
PbB
BmE
CaD
EaC
FOX
CaD
PbB
PbB
TwC
15
CvB
14
TwC
TwC
PbB
LcA
DeC
LaB
CaD
16
BpB
TwC
BpB
BpB
TwC
TwC
BpB
BpB
LaB
BpB
BsB
BsB
TwC
PbB
TwC
LcA
PbB
TwC
PbB


KINS COUNTY
R. 13 E.
R. 14 E.
N
2 Miles
10000 Feet
1
0
5000
0
1000
2000
3000
4000
5000
Scale 1:24 000
(Joins sheet 6)
(Joins sheet 14)
1 365 000 FEET
435 000 FEET
212
1
5
6
7
8
11
12
13
17
18
RIDGE
FOX
RIDGE
TdC
BpB
PbB
LcA
TwC
RoE
BsB
EaC
BmE
EaB
EdB
PbB
TsB
LaB
TsC
EdC
Gr
TdC
EaA
CaD
CvB
DeC
AtC
AsB
GaA
LaB
YaC
CaD

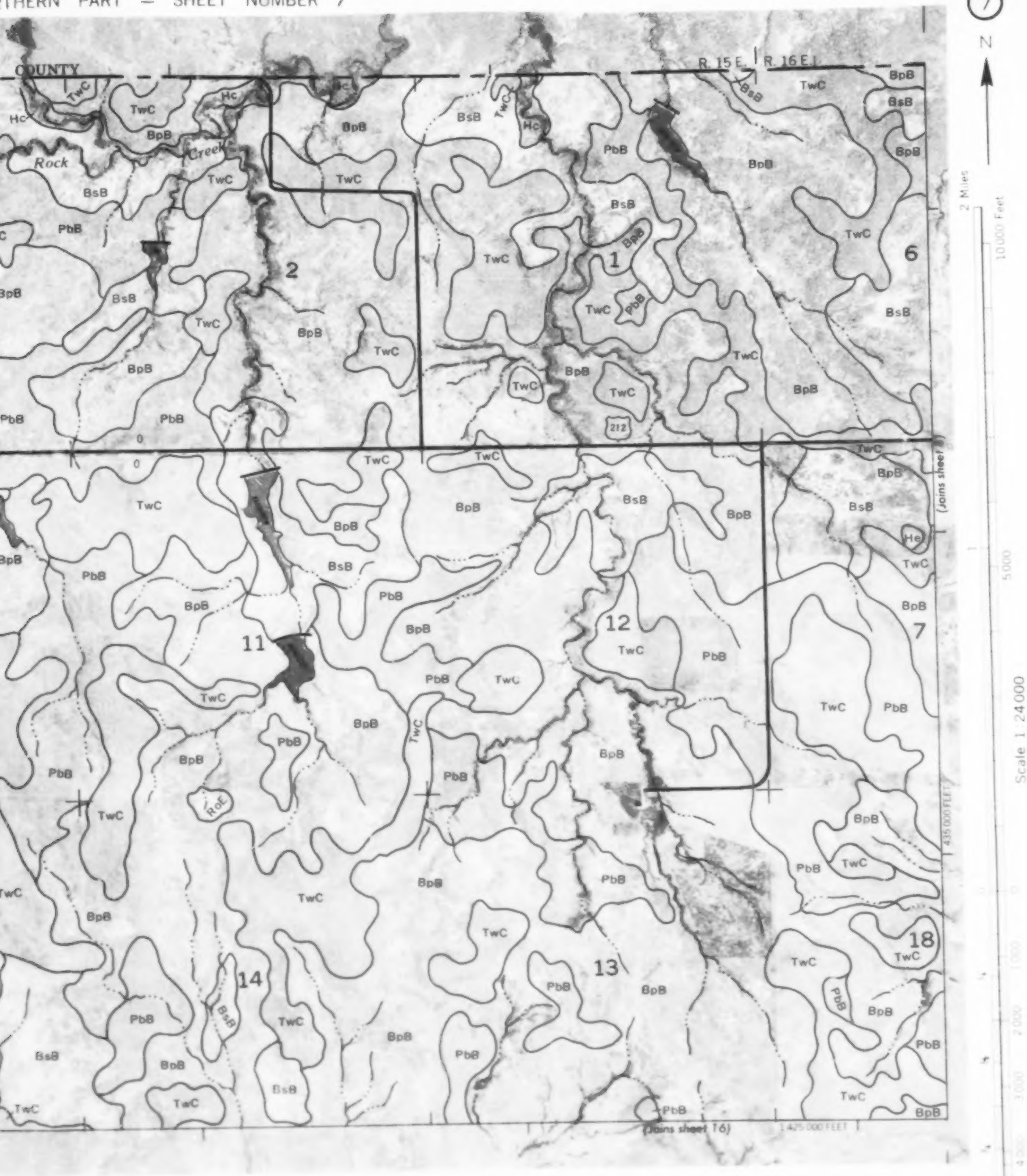

N
Scale 1:24000
2 Miles
1
0
½
¼
¾
10000 Feet
5000
0
1000
2000
3000
4000
5000
PERKINS
Slim Buttes
BlE
212
(Joins sheet 5)
(Joins sheet 15)
1 370 000 FEET
435 000 FEET
3
4
5
8
9
10
15
16
17
water
TwC
BsB
BpB
PbB
DeC
RoE
GaA
EaB
EaC
CaD
CvB
LaB
GaD
EdC
TsC
TsB
Hc
He
BsB

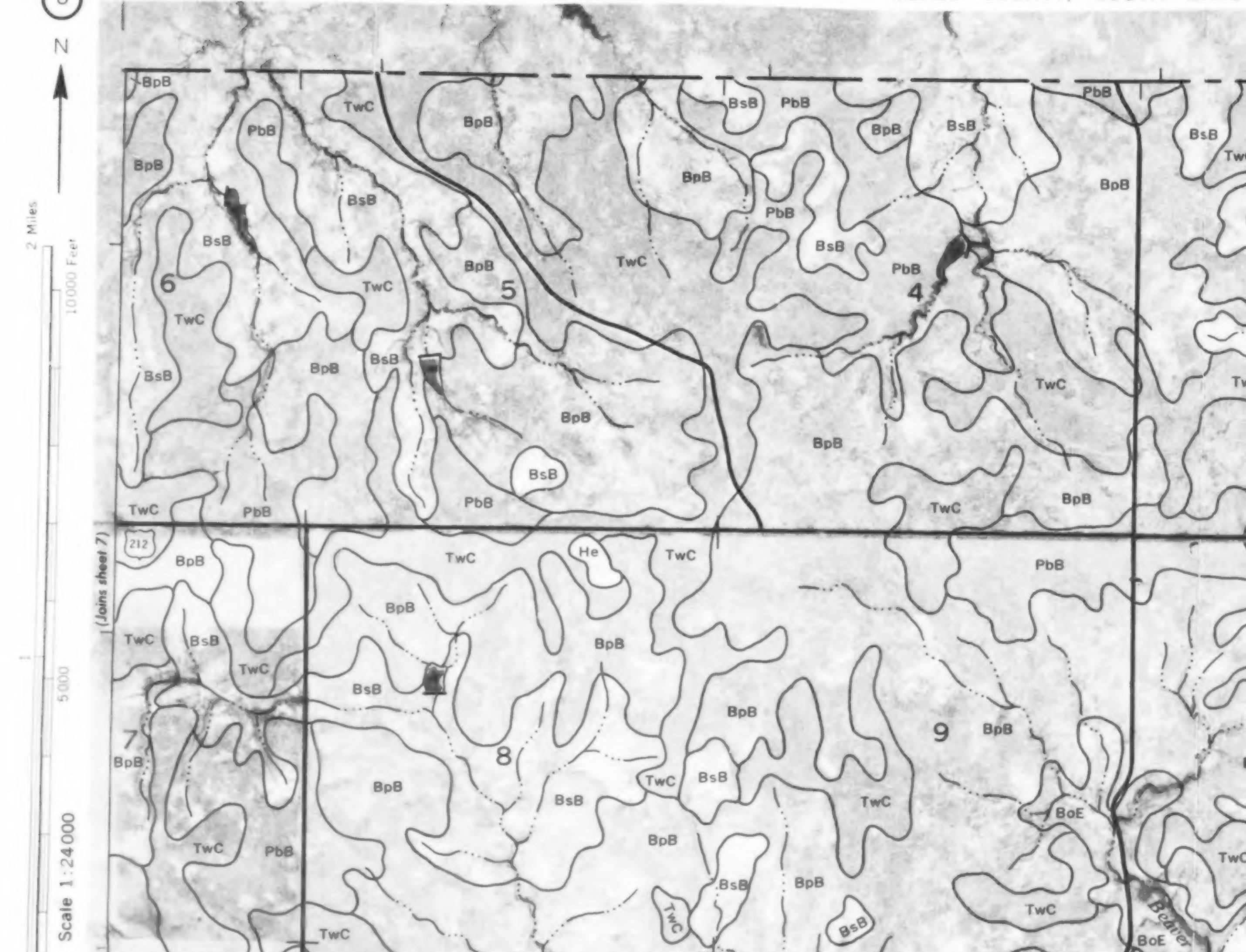
DAKOTA, NORTHERN PART — SHEET NUMBER 6

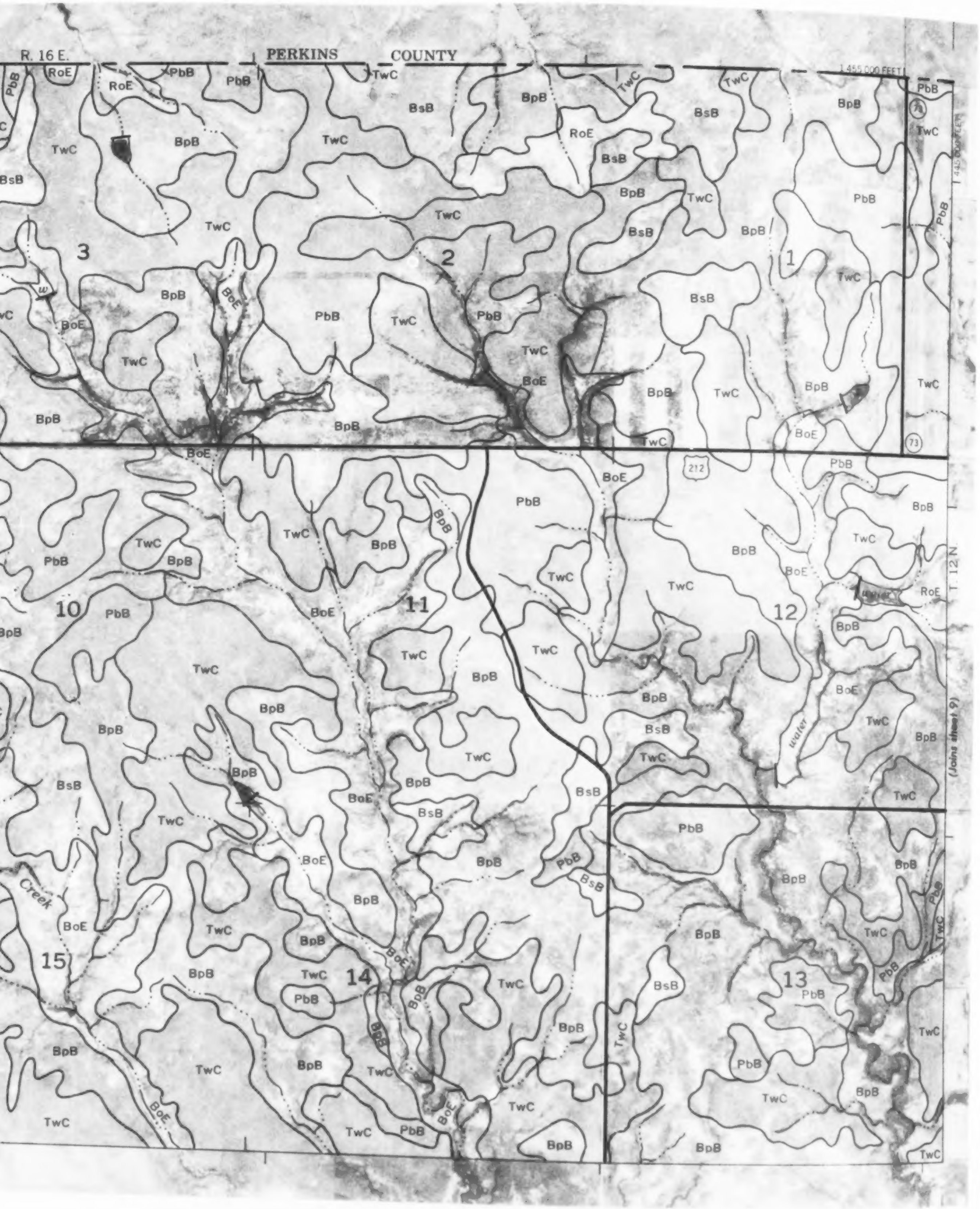

COUNTY
R. 14 E.
R. 15 E.
1 395 000 FEET
445 000 FEET
T. 12 N.
(Joins sheet 7)
212
Creek
Flin
1
2
6
7
11
12
13
14
18
TwC
PbB
BsB
BpB
BmE
EgB
EgC
DeC
EdC
BoE
RoE
Hc
He
CaD
AsB

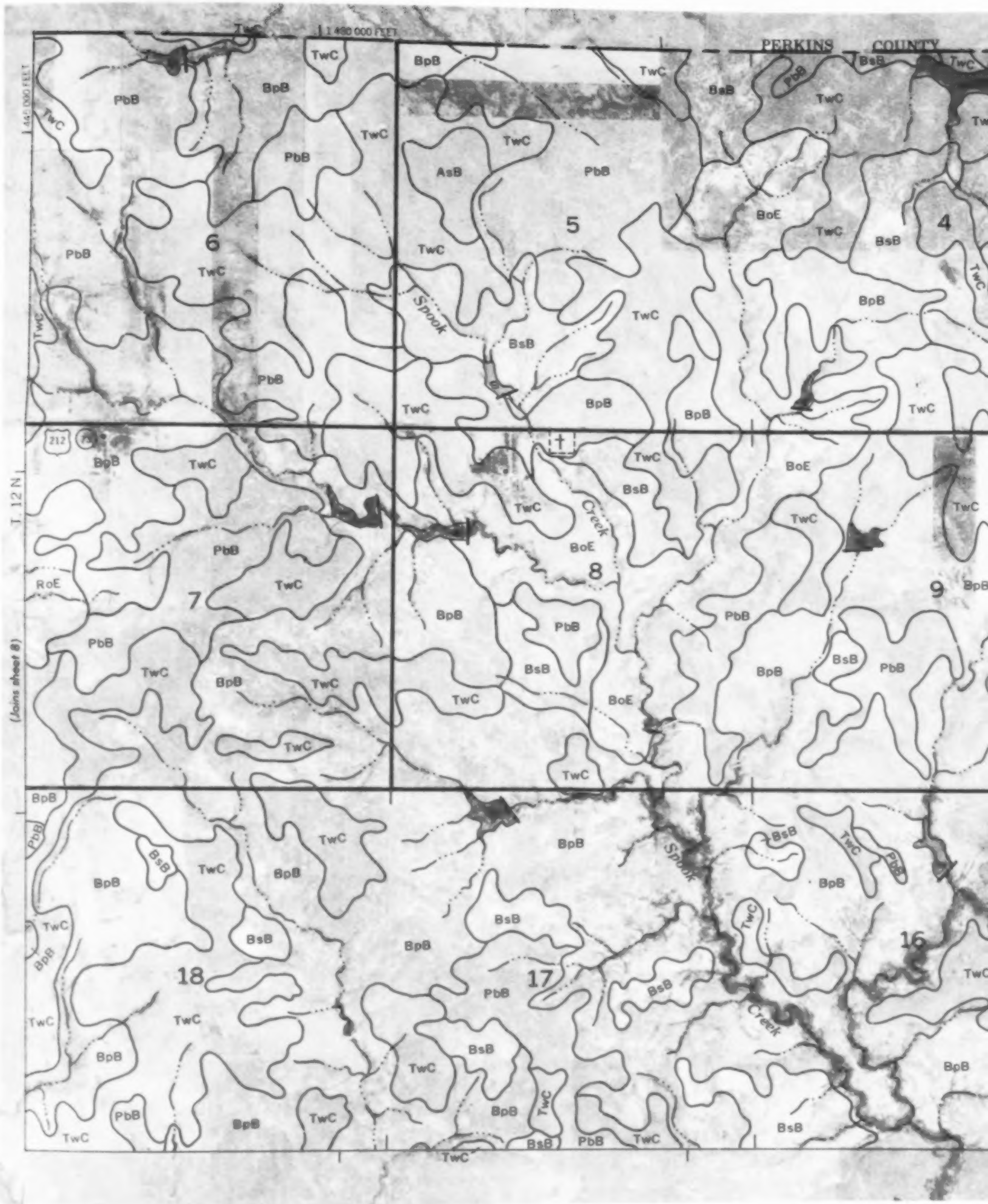

1 400 000 FEET
PERKINS
445 000 FEET
T. 12 N.
(Joins sheet 6)
212
Creek
Flint
water
5
4
3
8
9
10
17
16
15
TwC
DeC
Hc
PbB
BoE
BsB
BpB
EgB
GaA
CaD
RoE

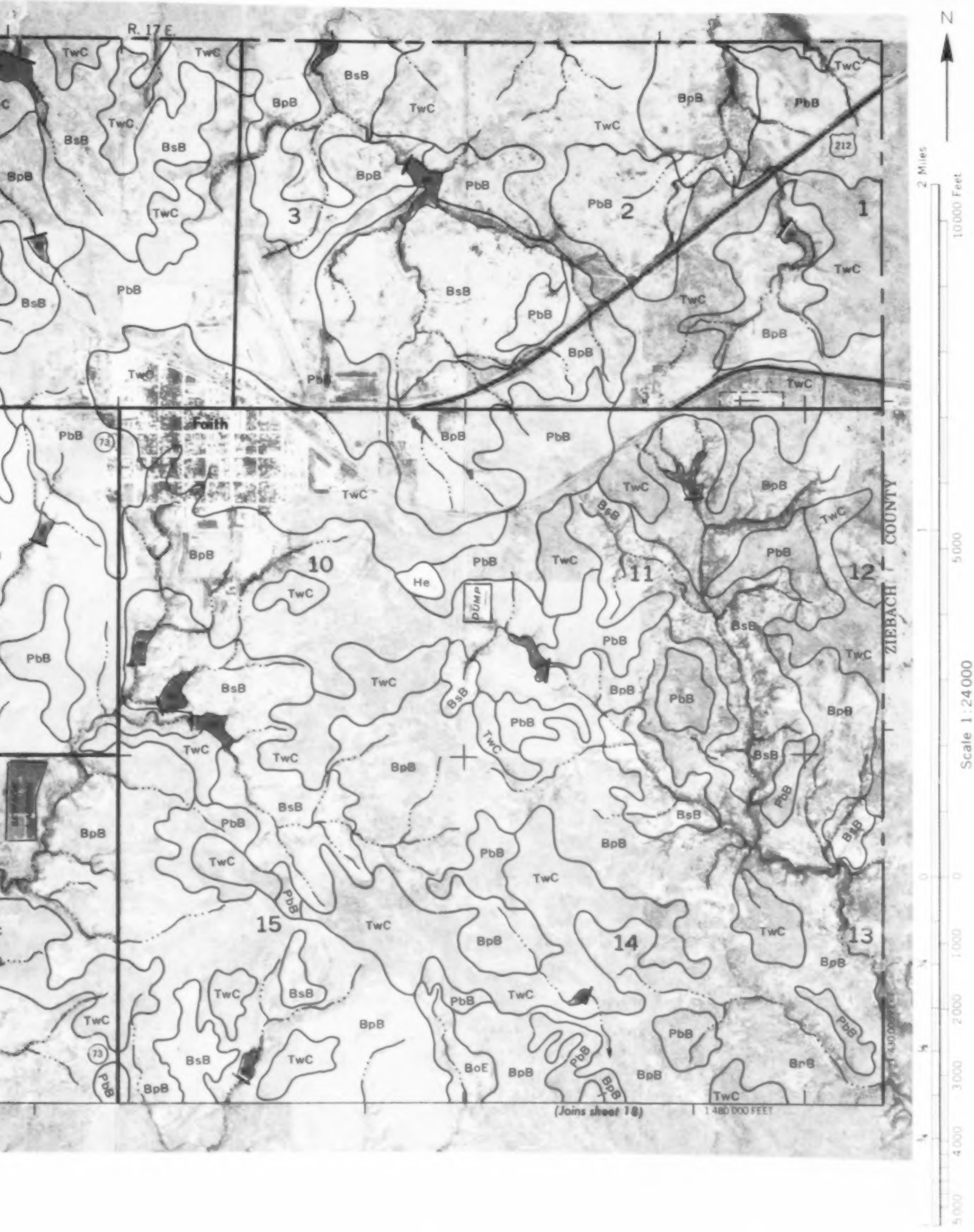
THERN PART — SHEET NUMBER 7

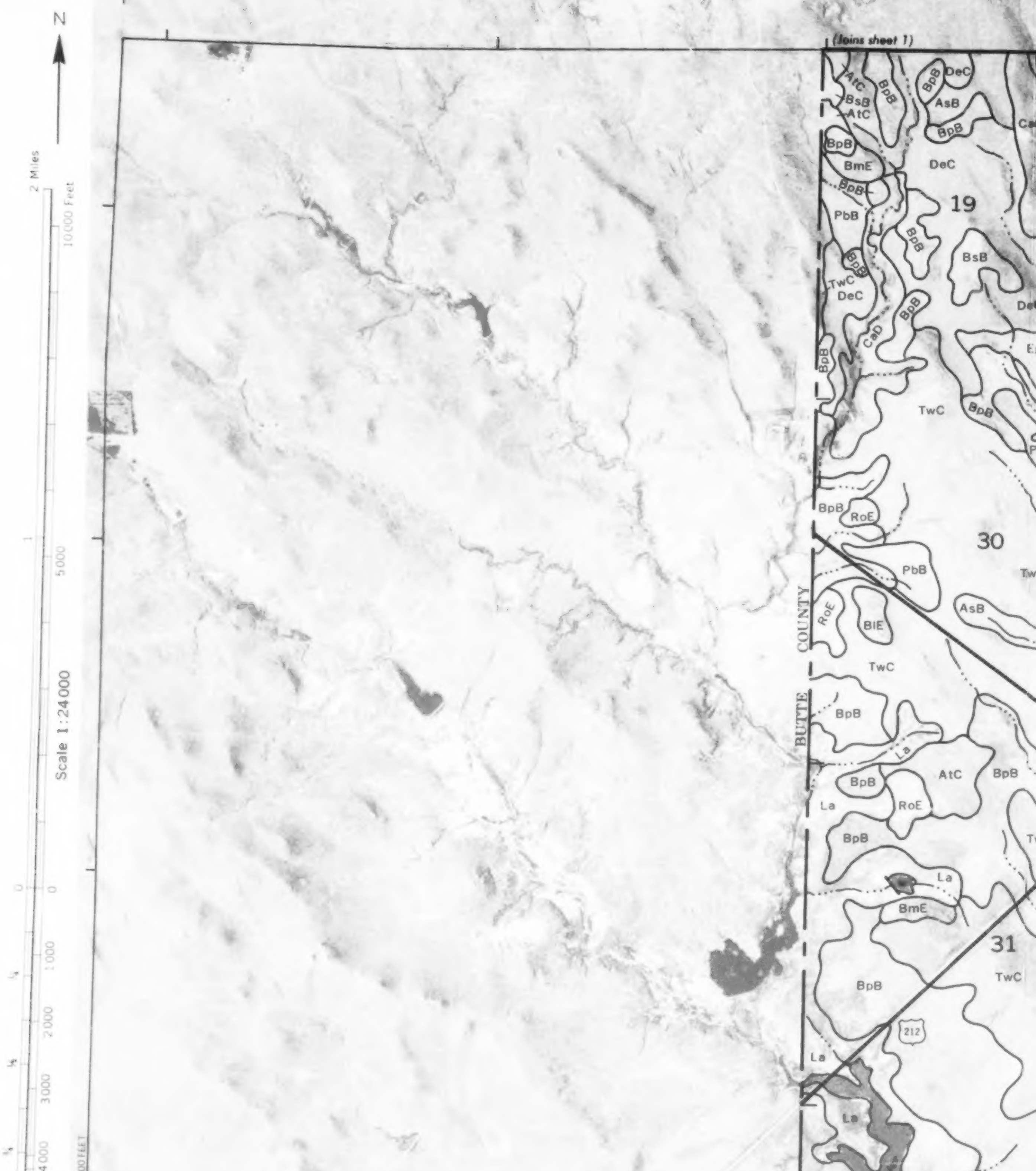

N
COUNTY
R. 15 E.
R. 16 E.
Rock
Creek
Hc
TwC
BpB
BsB
PbB
He
RoE
212
1
2
6
7
11
12
13
14
18
0
(Joins sheet 16)
(Joins sheet
435 000 FEET
1 425 000 FEET
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000


N
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
(Joins sheet 7)
(Joins sheet 17)
212
1 435 000 FEET
1 430 000 FEET
4
5
6
7
8
9
16
17
18
BpB
PbB
BsB
TwC
He
BoE
RoE
Beaver
water
w

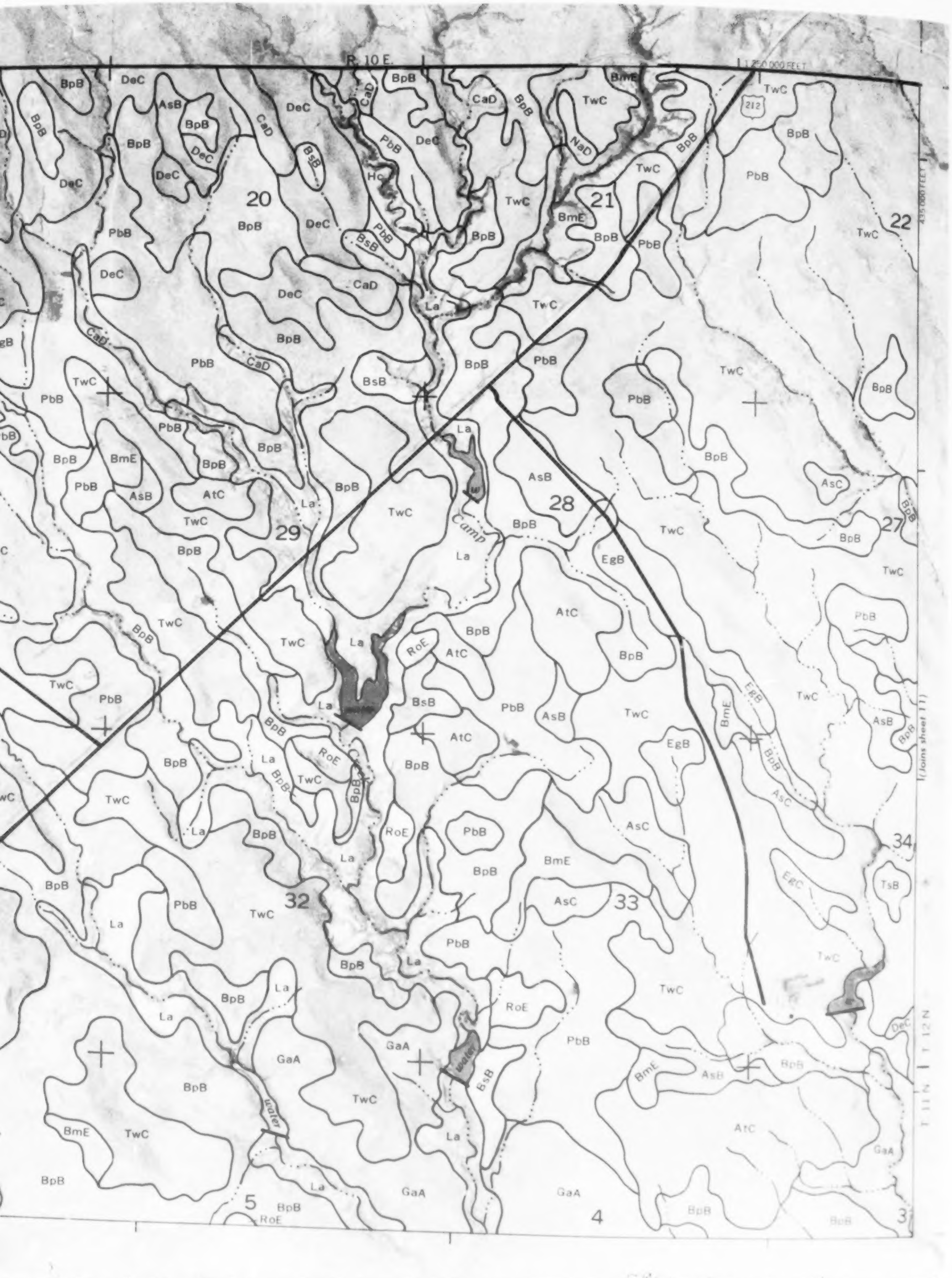

R. 16 E.
PERKINS COUNTY
1 455 000 FEET
445 000 FEET
T. 12 N.
(Joins sheet 9)
212
73
1
2
3
10
11
12
13
14
15
RoE
PbB
BpB
BsB
TwC
BoE
Creek
water
w


1 480 000 FEET
440 000 FEET
PERKINS COUNTY
T. 12 N.
(Joins sheet 8)
212
73
Spook
Creek
Spook
Creek
4
5
6
7
8
9
16
17
18
TwC
PbB
BpB
AsB
BsB
BoE
RoE

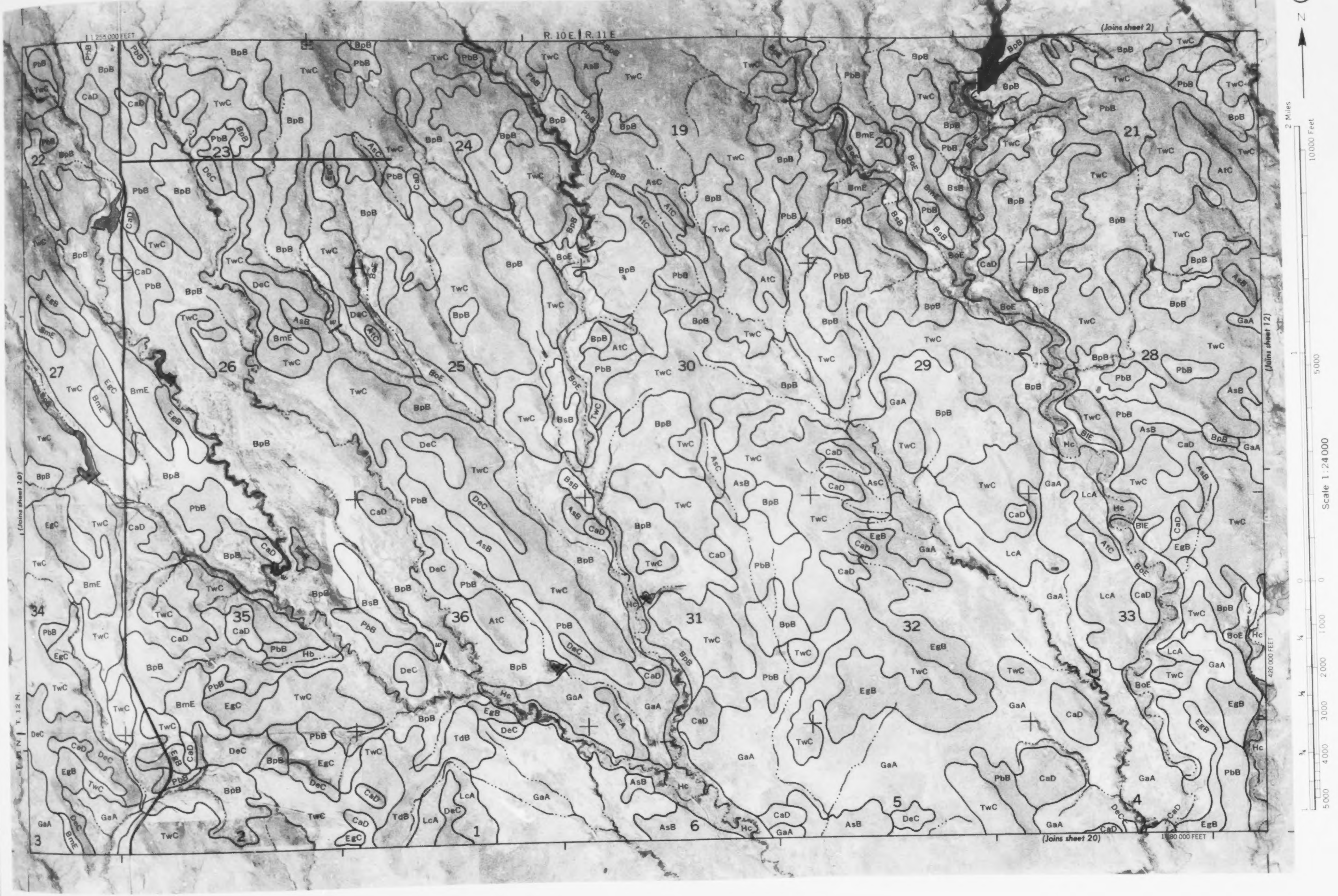

R. 17 E.
N
212
73
Faith
DUMP
ZIEBACH COUNTY
(Joins sheet 18)
1 480 000 FEET
1
2
3
10
11
12
13
14
15
TwC
BsB
BpB
PbB
He
BoE
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000


N
Scale 1:24 000
2 Miles
1
0
¼
½
¾
10 000 Feet
5000
0
1000
2000
3000
4000
5000
400 000 FEET
1 225 000 FEET
(Joins sheet 1)
(Joins sheet 19)
BUTTE COUNTY
19
30
31
6
212
AtC
BsB
AtC
BpB
BpB
DeC
AsB
BpB
Ca
BpB
BmE
BpB
DeC
PbB
BpB
BpB
BsB
BpB
TwC
DeC
BpB
CaD
De
BpB
El
TwC
BpB
P
BpB
RoE
PbB
RoE
BlE
AsB
Tw
TwC
BpB
La
BpB
AtC
BpB
La
RoE
BpB
Tw
La
BmE
TwC
BpB
La
La
BpB
La

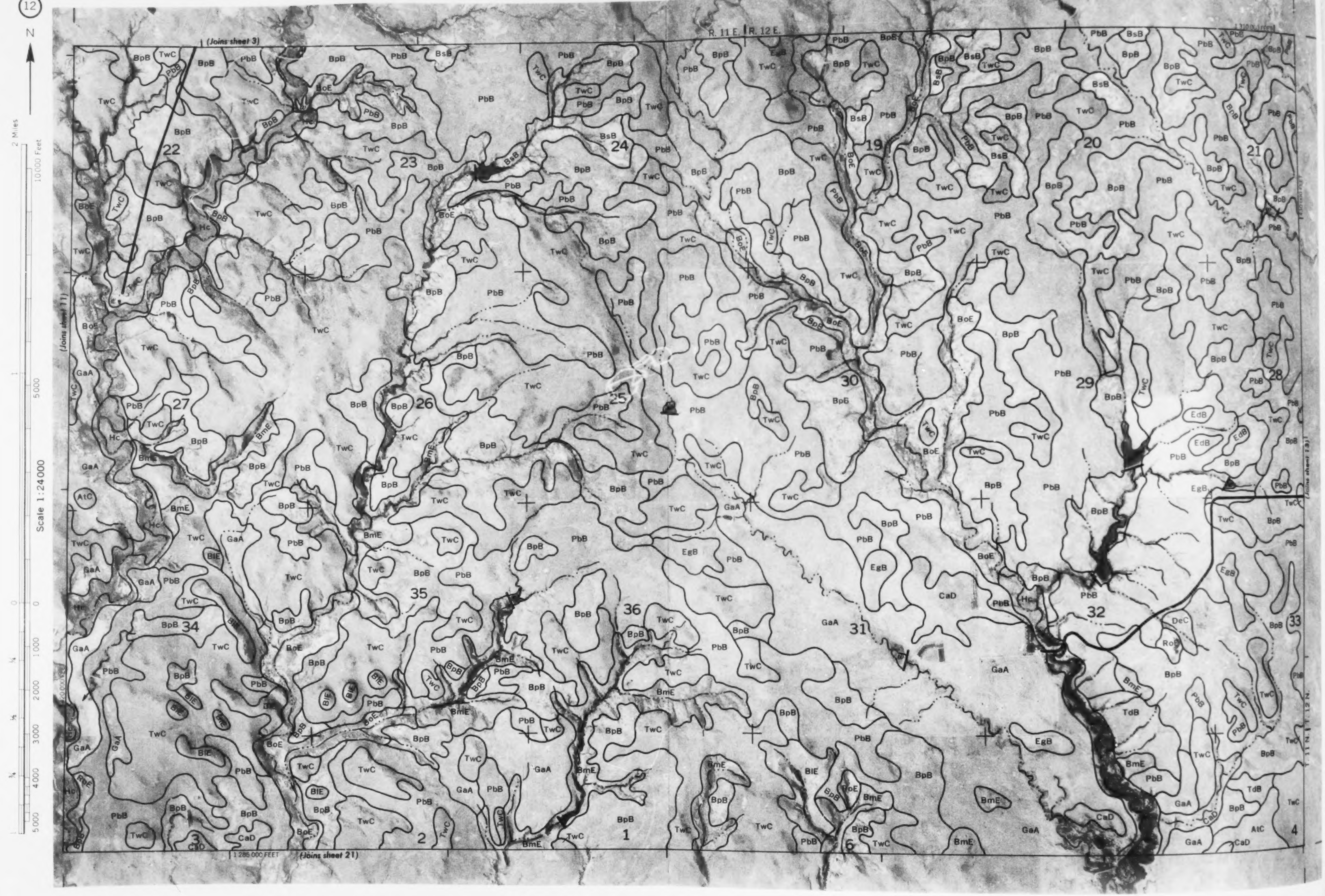
AKOTA, NORTHERN PART — SHEET NUMBER 10


R. 10 E.
1 250 000 FEET
435 000 FEET
212
(Joins sheet 11)
T. 12 N.
T. 11 N.
20
21
22
28
29
27
32
33
34
5
4
3
Camp
Cr.
water
BpB
DeC
AsB
CaD
BsB
PbB
TwC
BmE
NaD
Hc
La
AtC
EgB
RoE
AsC
EgC
TsB
GaA

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 11

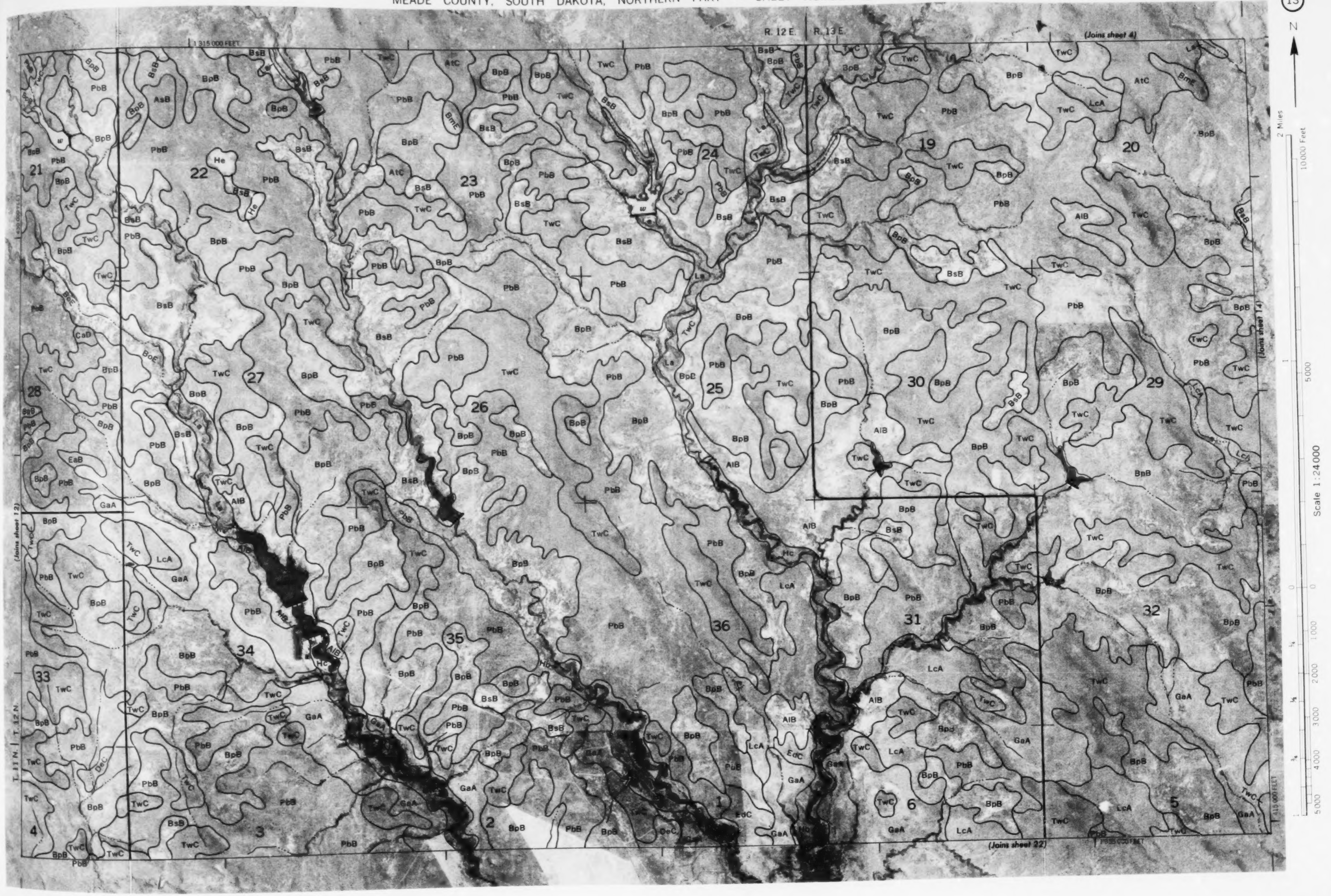

N
(Joins sheet 2)
R. 10 E. | R. 11 E.
1 255 000 FEET
(Joins sheet 12)
(Joins sheet 10)
(Joins sheet 20)
1 280 000 FEET
420 000 FEET
T. 12 N.
2 Miles
1
0
10000 Feet
5000
0
Scale 1:24 000
1000
2000
3000
4000
5000
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
TwC
BpB
PbB
CaD
DeC
AsB
AsC
AtC
BmE
BoE
BsB
BlE
EgB
EgC
GaA
Hb
Hc
LcA
TdB

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 12

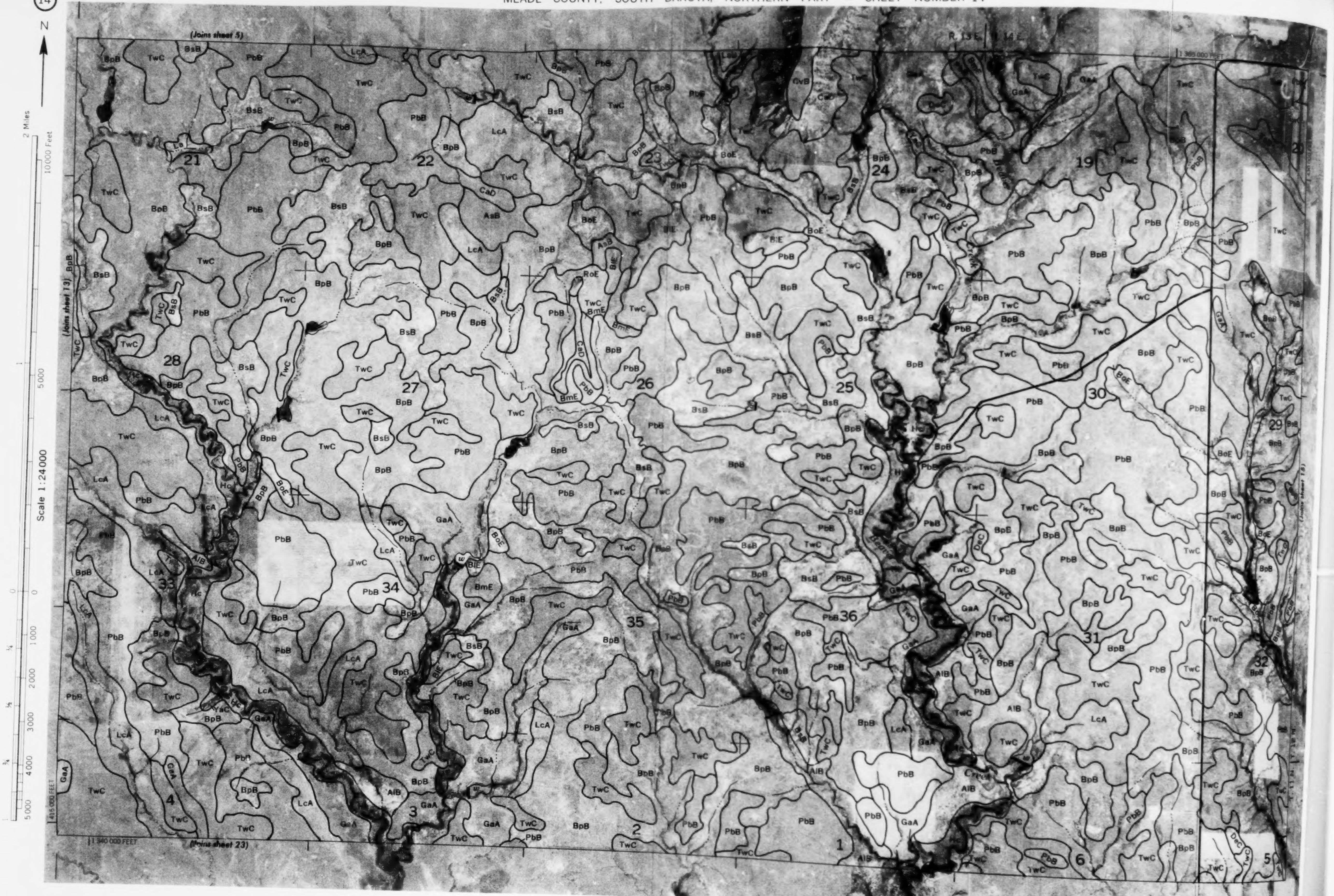

N
Scale 1:24 000
2 Miles
10000 Feet
5000
1
0
1000
2000
3000
4000
5000
(Joins sheet 3)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 21)
1 285 000 FEET
R. 11 E. | R. 12 E.
T. 11 N. | T. 12 N.
22
23
24
19
20
21
27
26
25
30
29
28
35
36
31
32
33
34
3
2
1
6
4
TwC
PbB
BpB
BsB
BoE
Hc
BmE
BlE
GaA
AtC
EgB
EdB
DeC
RoB
CaD
TdB

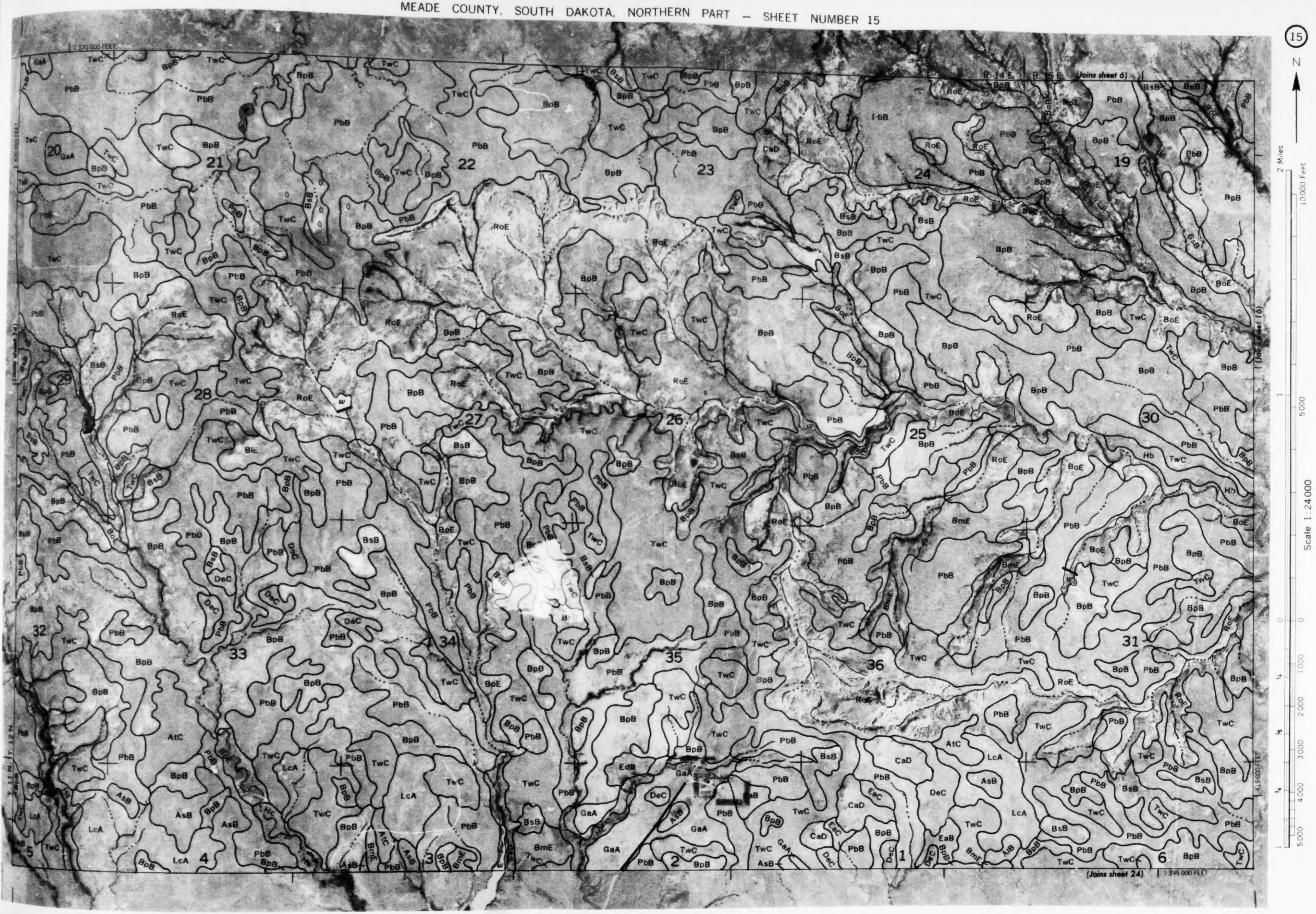
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 13

⑬

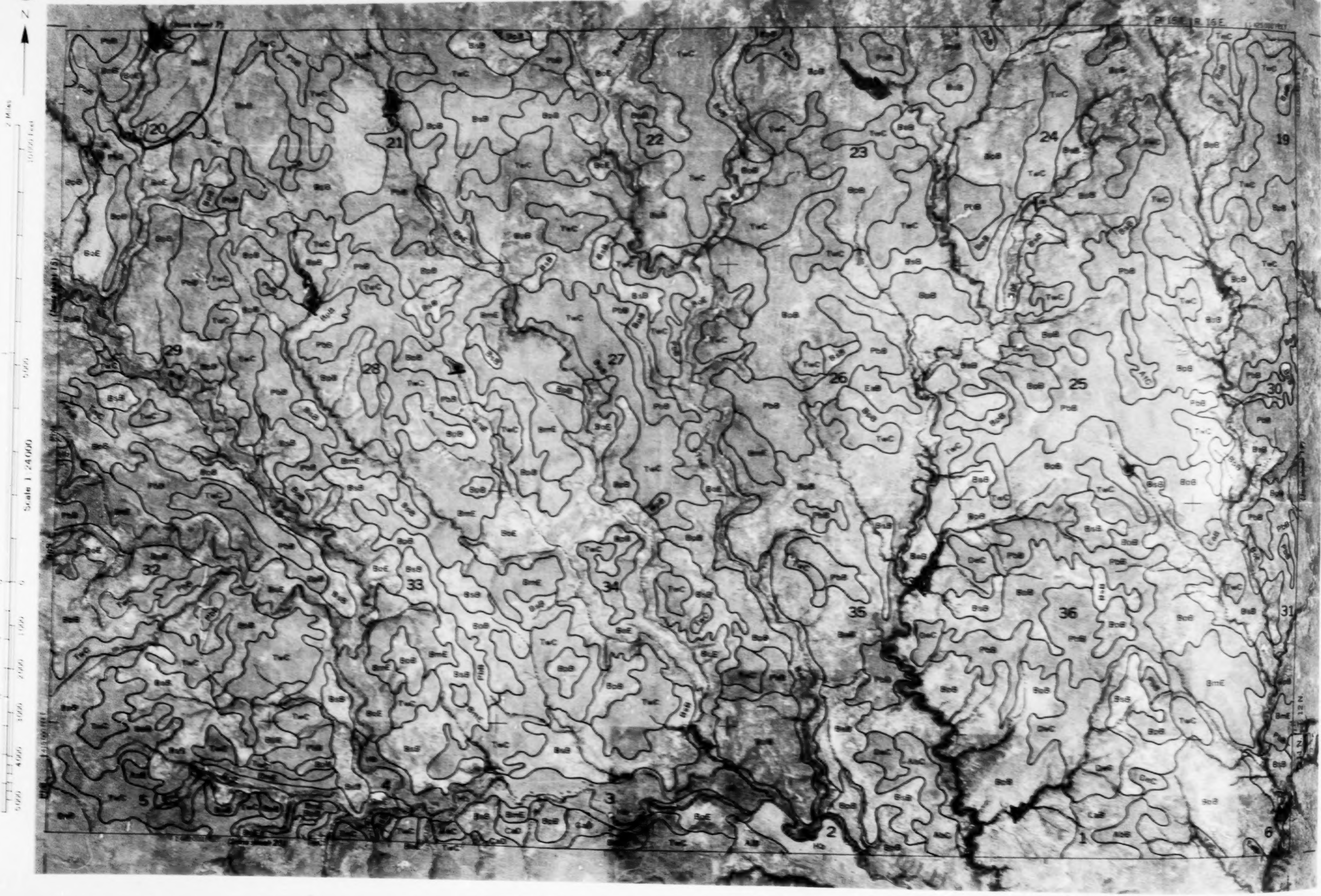


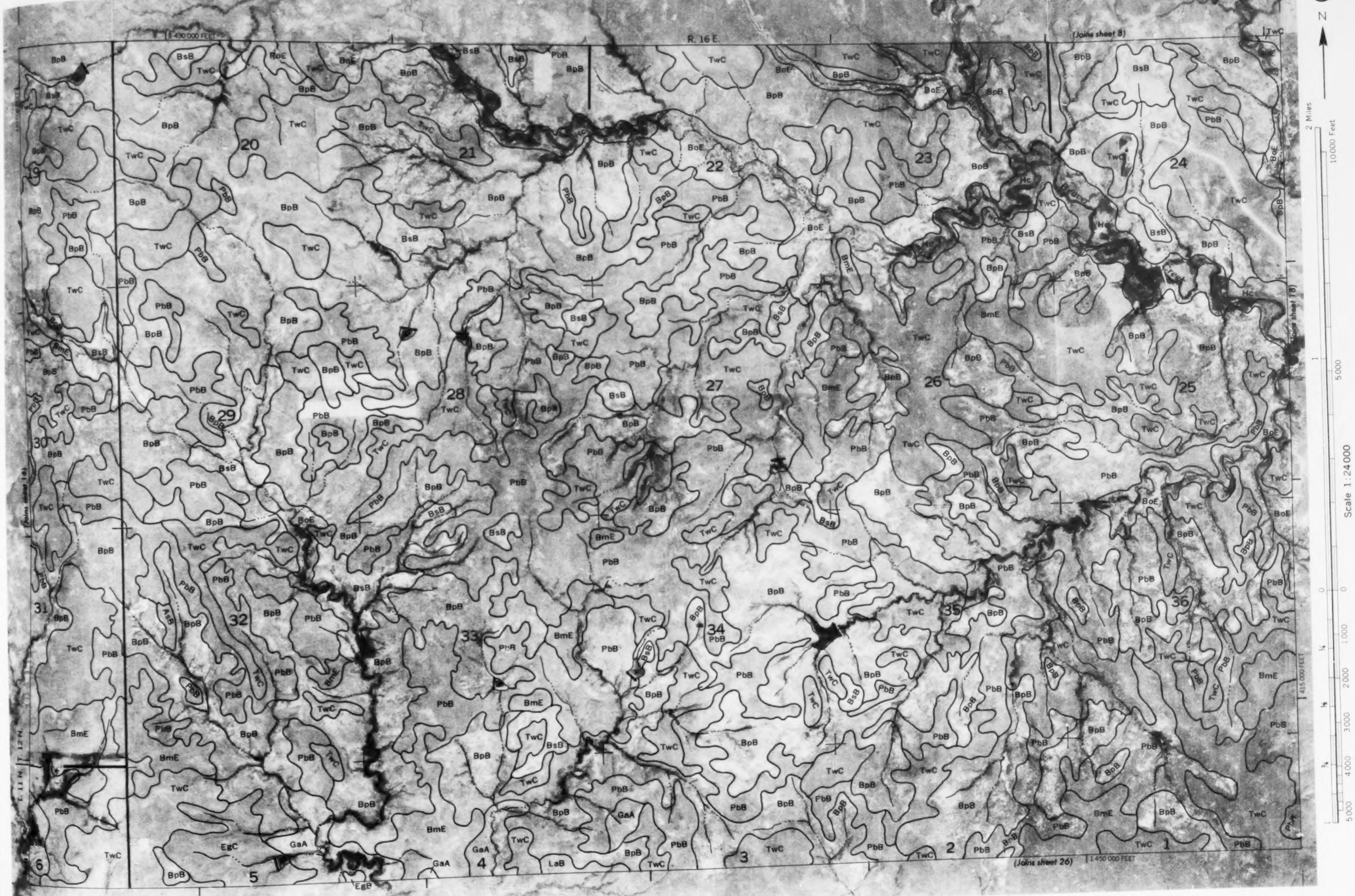
N
2 Miles
10000 Feet
Scale 1:24 000
(Joins sheet 4)
(Joins sheet 14)
(Joins sheet 22)
(Joins sheet 12)
R. 12 E.
R. 13 E.
T. 12 N.
T. 11 N.
1 315 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6


N
2 Miles
10000 Feet
5000
Scale 1:24000
0
1000
2000
3000
4000
5000
(Joins sheet 5)
(Joins sheet 13)
(Joins sheet 23)
(Joins sheet 15)
R. 13 E.
R. 14 E.
1 365 000 FEET
1 340 000 FEET
415 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
TwC
PbB
BpB
BsB
LcA
CaD
AsB
BoE
BIE
BmE
RoE
GaA
AIB
DeC
Hc
La
Creek

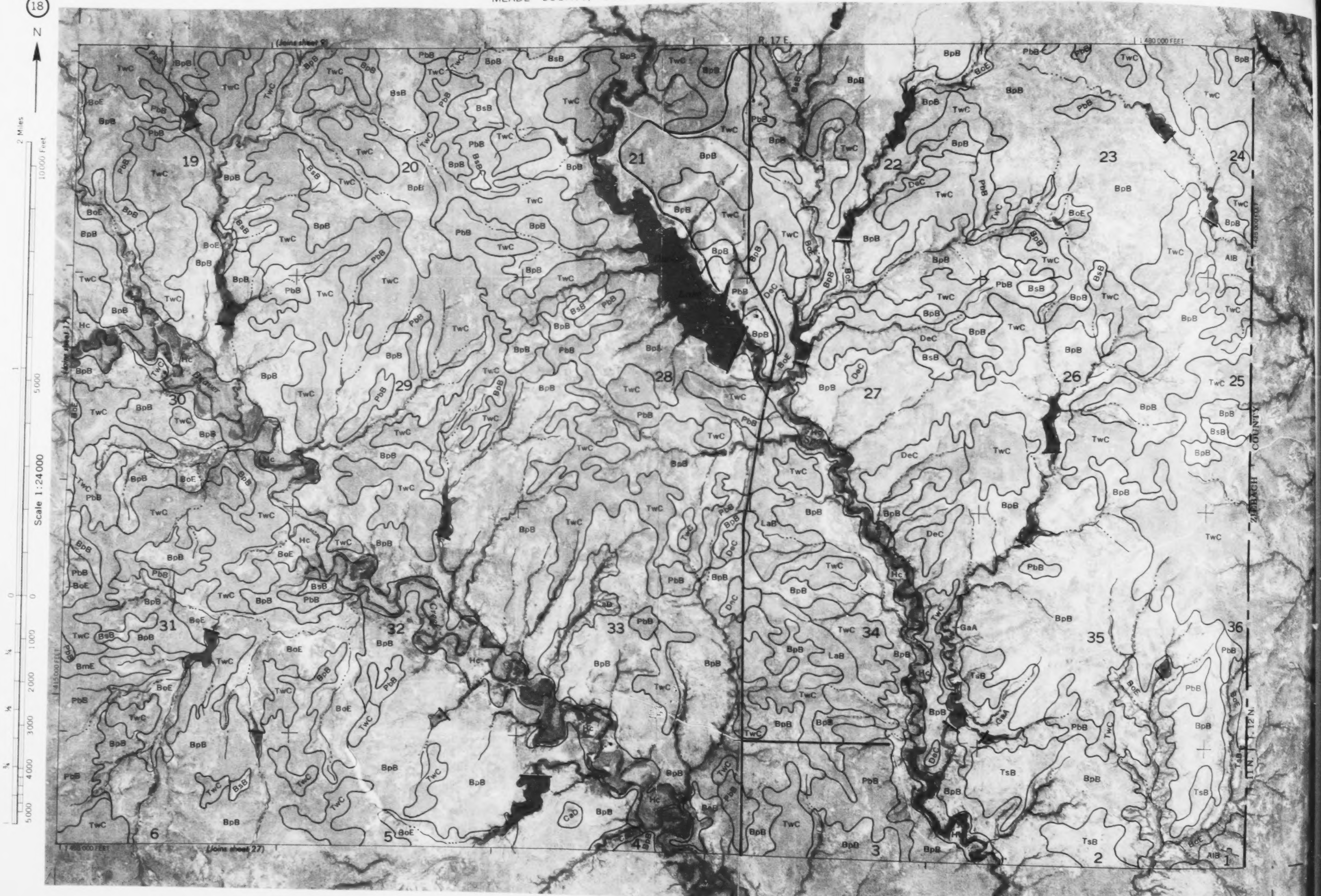

1 370 000 FEET
R. 14 E.
R. 15 E.
(Joins sheet 6)
(Joins sheet 16)
(Joins sheet 24)
(Joins sheet 14)
1 395 000 FEET
415 000 FEET
T. 12 N.
T. 11 N.
N
2 Miles
10 000 Feet
Scale 1:24 000
5000
0
1000
2000
3000
4000
5000
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
PbB
BpB
TwC
RoE
BsB
BoE
BmE
CaD
GaA
DeC
LcA
AsB
AtC
EdB
EaC
AlB
Hb
BlE

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 16

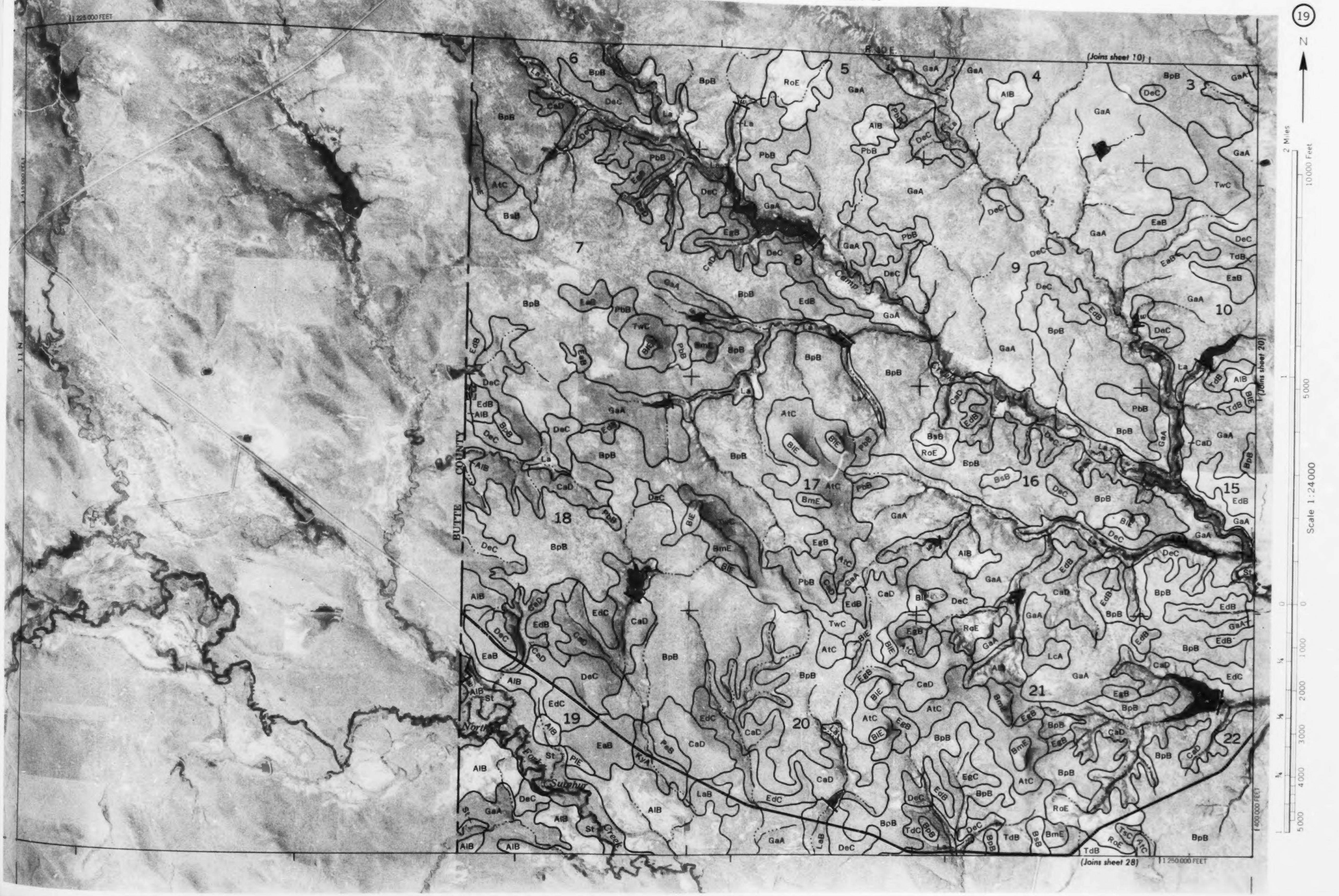

N
2 Miles
10000 Feet
Scale 1:24000
R. 16 E.
T. 12 N.
20
21
22
23
24
19
29
28
27
26
25
30
32
33
34
35
36
31
5
4
3
2
1
6
BoB
BsB
TeC
PtB
BmE
BoE
DaC
CaB
AbB
Hs


1 430 000 FEET
R. 16 E.
(Joins sheet 8)
(Joins sheet 18)
(Joins sheet 16)
(Joins sheet 26)
1 450 000 FEET
415 000 FEET
T. 12 N.
T. 11 N.
Beaver Creek
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
BpB
BsB
TwC
PbB
BoE
BmE
Hc
AsB
EgC
EgB
GaA
LaB
N
2 Miles
10000 Feet
5000
1
0
Scale 1:24000
0
1000
2000
3000
4000
5000

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 18

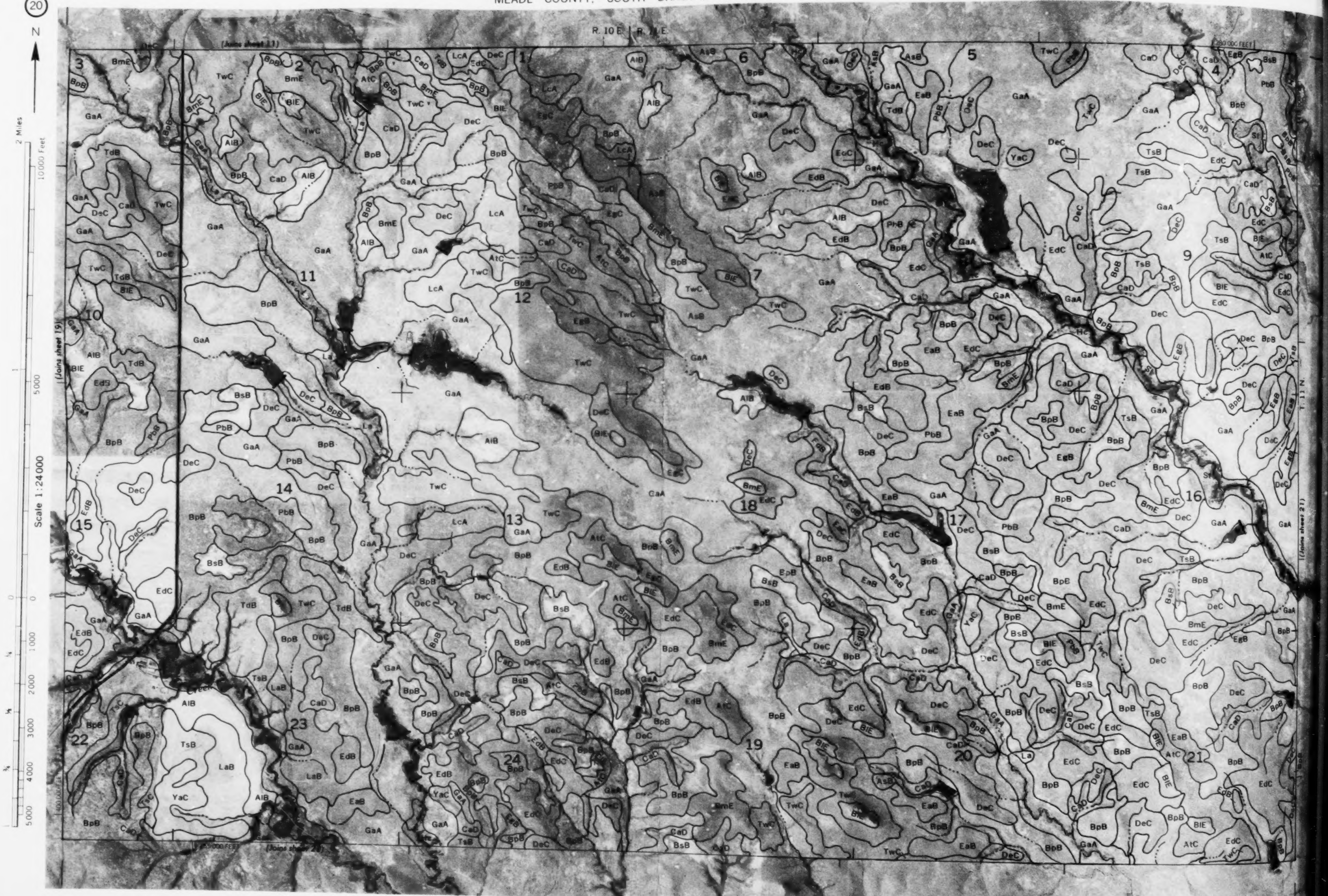

N
Scale 1:24000
2 Miles
10000 Feet
1
0
5000
4000
3000
2000
1000
(Joins sheet 9)
(Joins sheet 17)
(Joins sheet 27)
R. 17 E.
T. 12 N.
ZIEBACH COUNTY
1 480 000 FEET
1 445 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
Creek
BpB
TwC
PbB
BsB
BoE
DeC
Hc
LaB
TsB
GaA
GaB
AlB
BmE

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 19

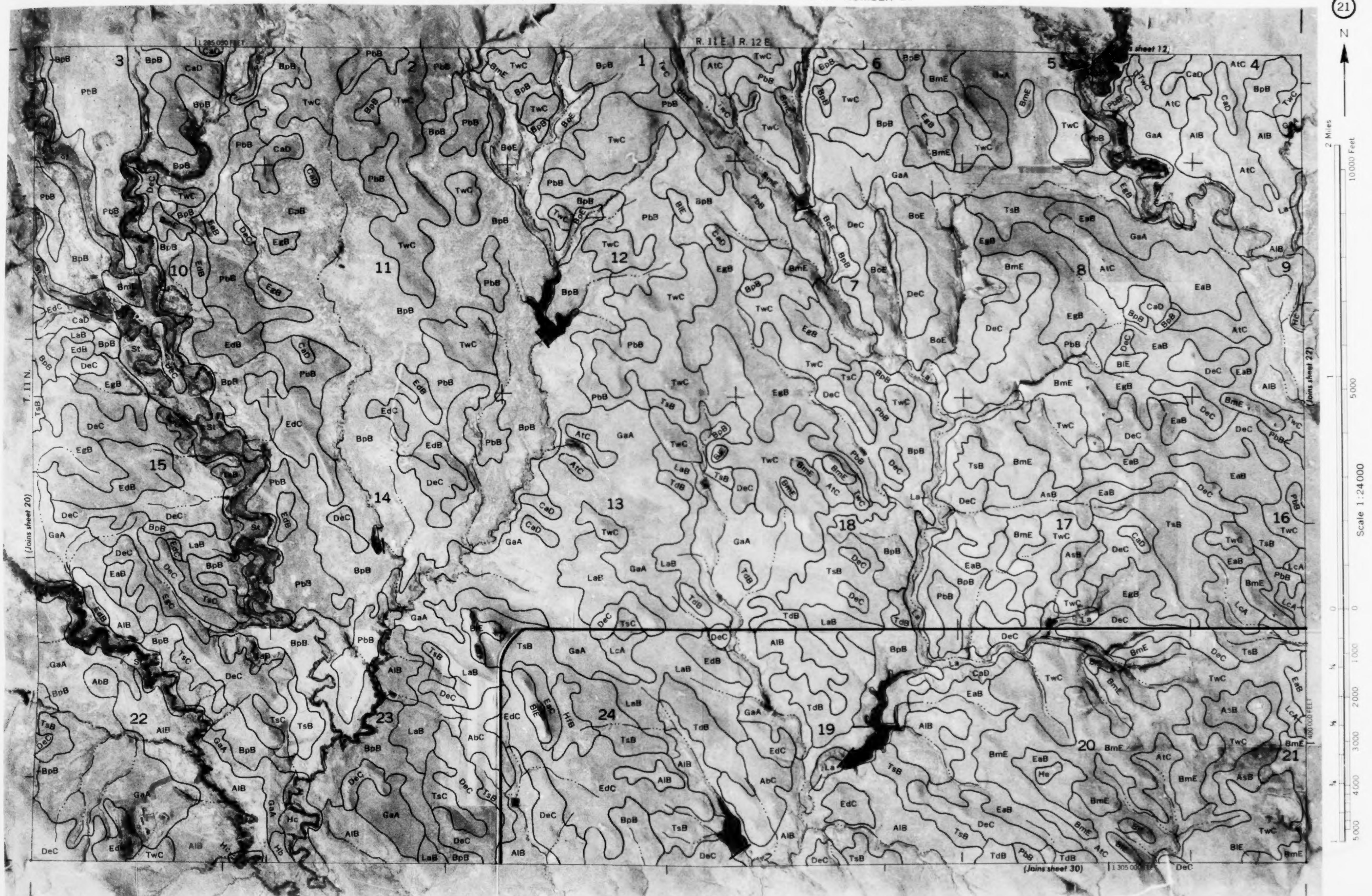


19
N
(Joins sheet 10)
(Joins sheet 20)
(Joins sheet 28)
R. 10 E.
T. 11 N.
BUTTE COUNTY
Camp Creek
North Fork Sulphur Creek
1 225 000 FEET
1 250 000 FEET
1 400 000 FEET
2 Miles
10000 Feet
Scale 1:24000
3
4
5
6
7
8
9
10
15
16
17
18
19
20
21
22
BpB
GaA
DeC
AtC
CaD
EdB
PbB
La
AlB
RoE
TwC
BlE
BmE
EaB
EgB
EdC
BsB
TdB
LcA
LaB
KyA
PlE
St
TsC
TdC
EgC

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 20

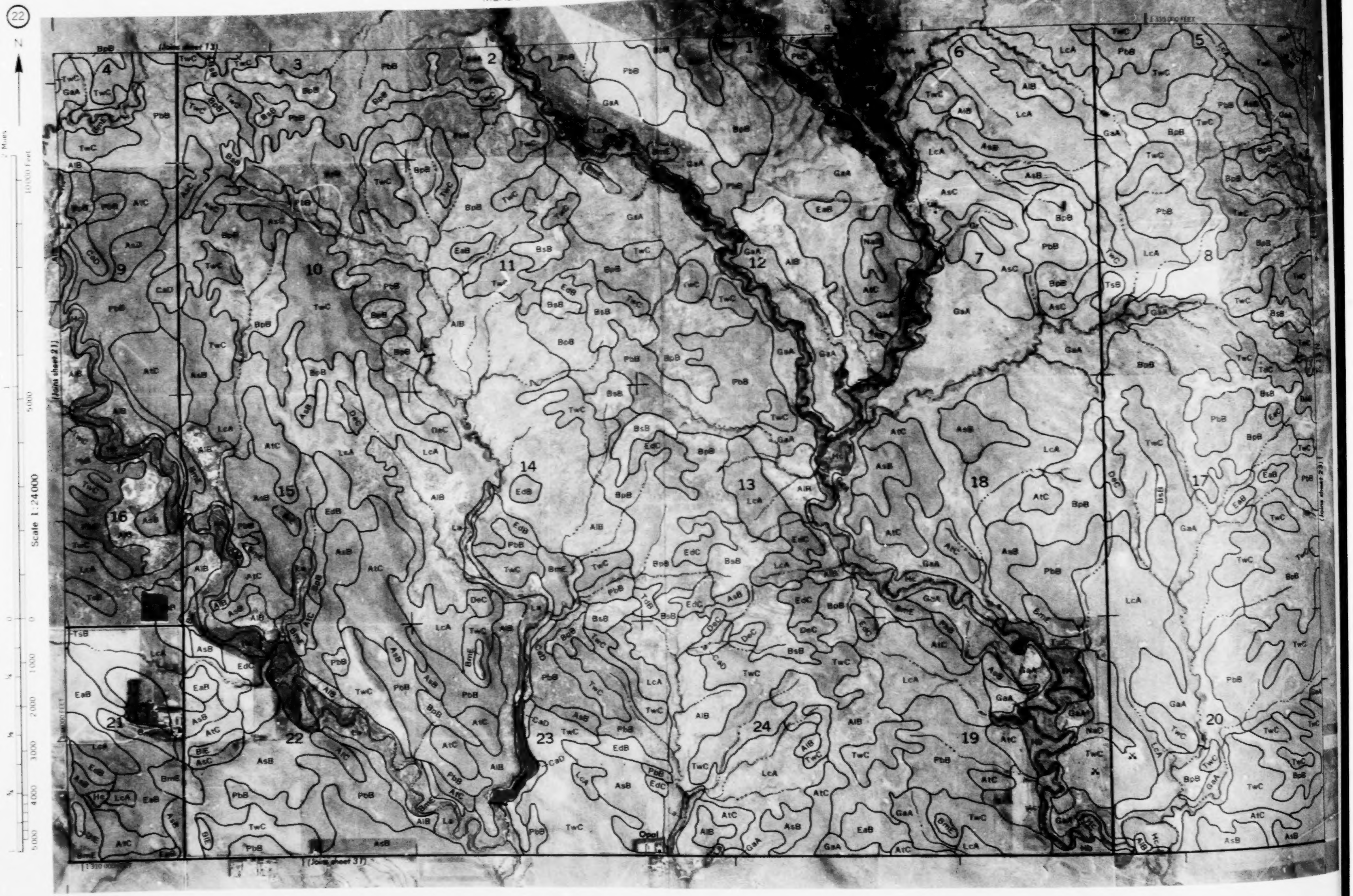

N
2 Miles
10000 Feet
5000
Scale 1:24 000
0
1000
2000
3000
4000
5000
R. 10 E. | R. 11 E.
(Joins sheet 11)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 28)
T. 11 N.
Creek

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 21



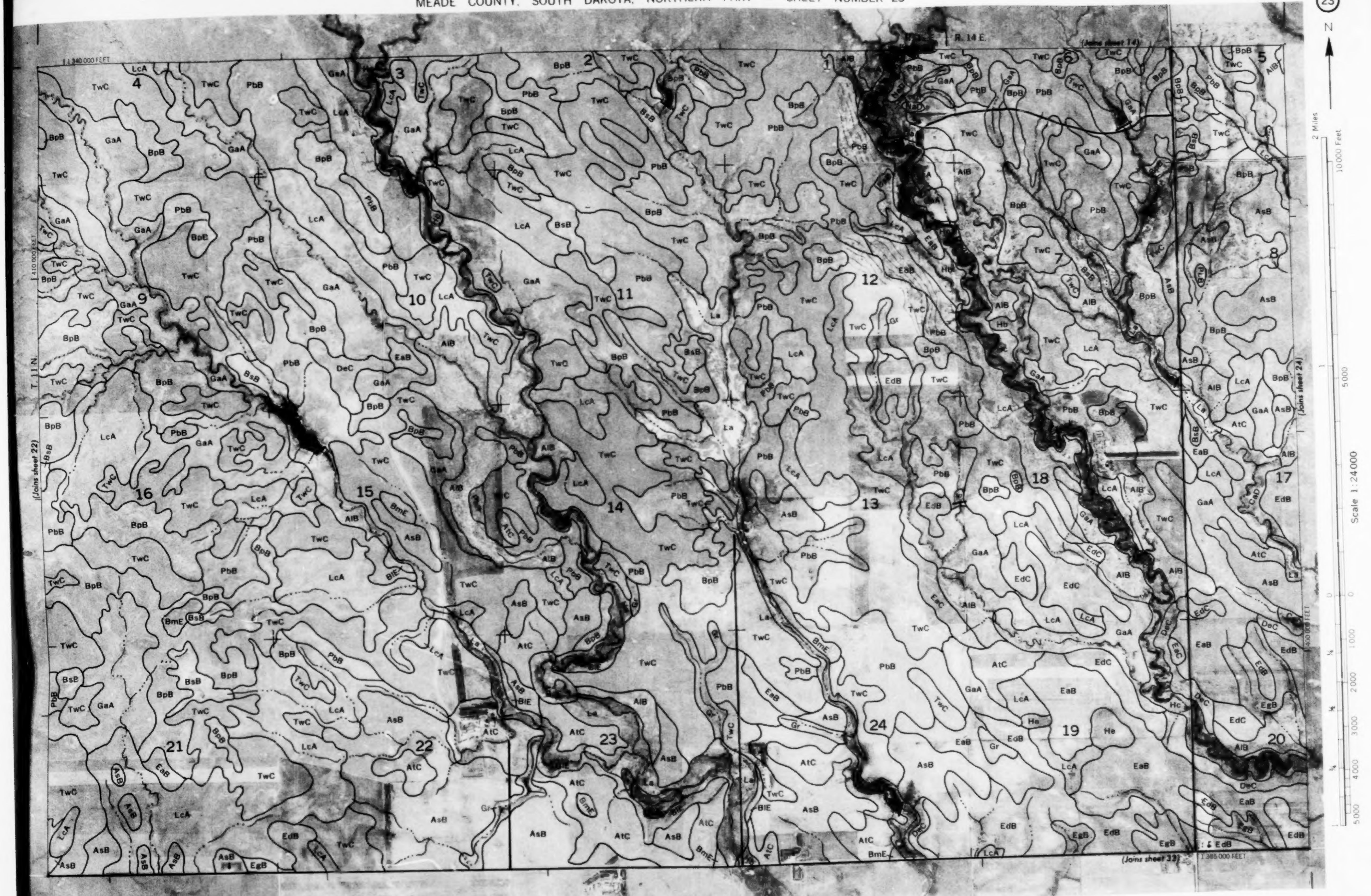
(21)
N
1 285 000 FEET
R. 11 E.
R. 12 E.
(Joins sheet 12)
T. 11 N.
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 30)
1 305 000 FEET
400 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
BpB
PbB
CaD
TwC
BmE
BoE
DeC
EgB
EdB
EdC
GaA
AtC
AlB
EaB
TsB
TsC
LaB
La
LcA
St
BlE
DeC
TdB
AsB
AbB
AbC
Hc
He
HfB

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 22

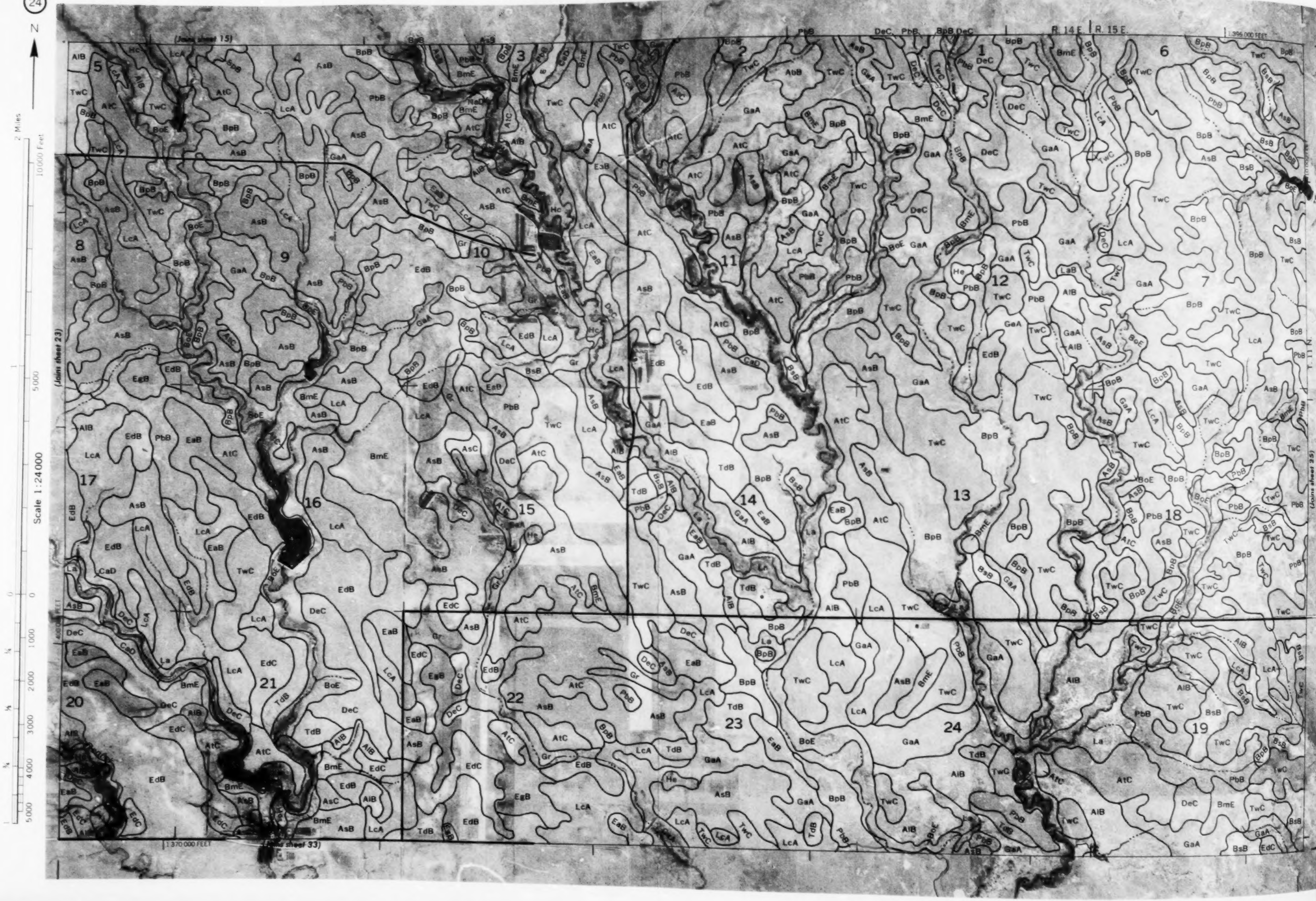

22
N
(Joins sheet 13)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 31)
1 335 000 FEET
1 310 000 FEET
Scale 1:24000
1 Mile
10000 Feet
5000
0
1000
2000
3000
4000
5000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Opal

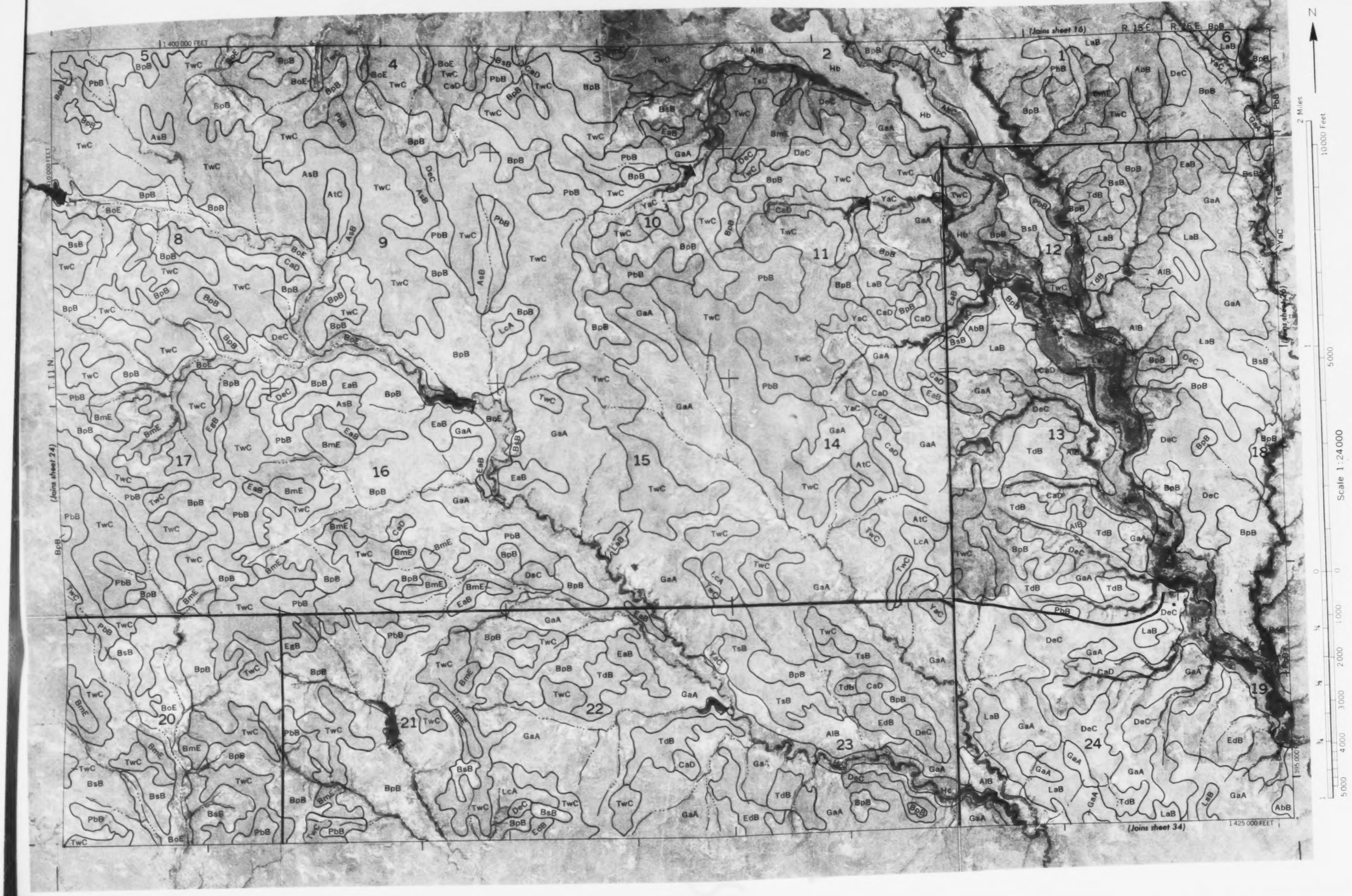
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 23

㉓

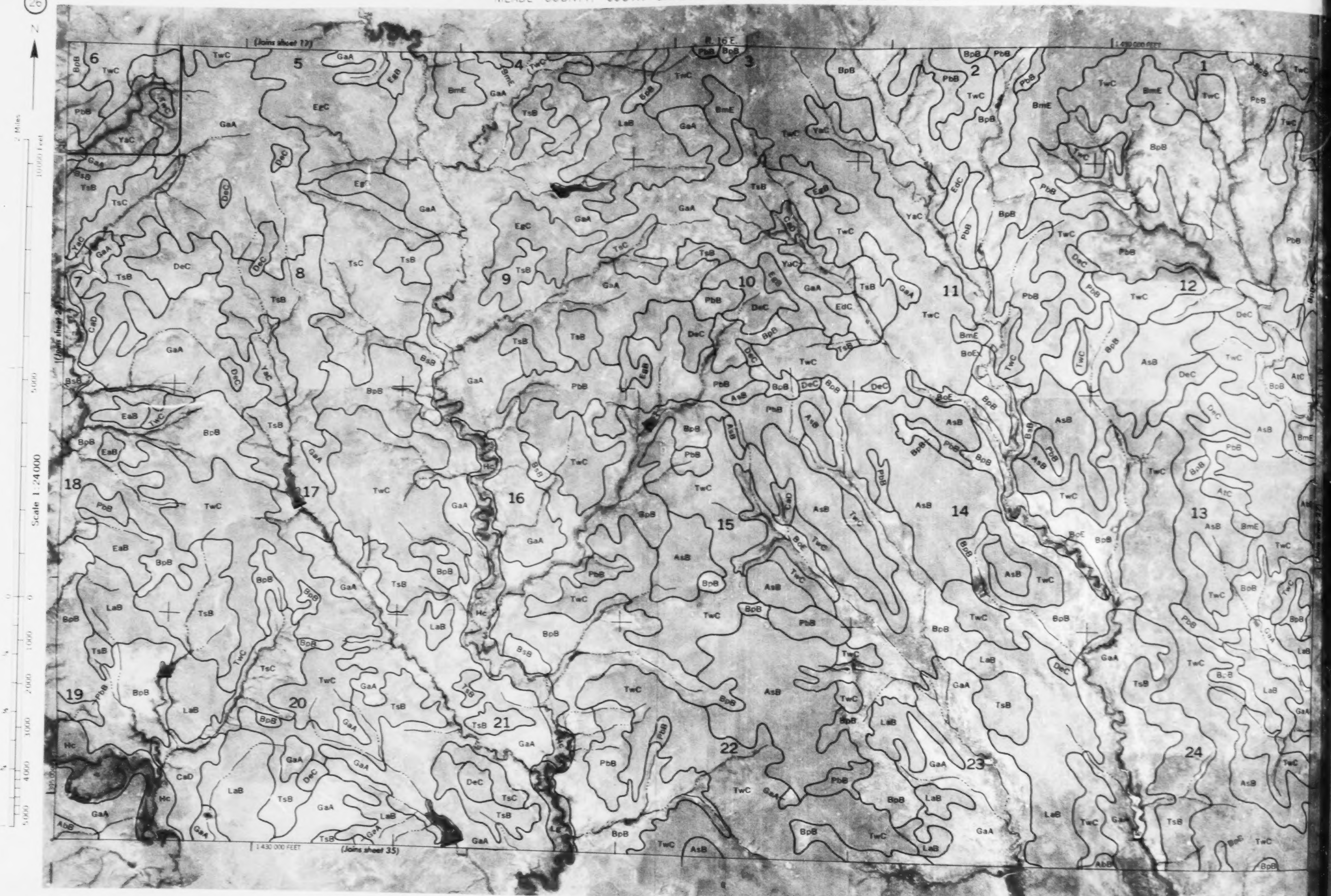

N
R. 14 E.
(Joins sheet 14)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 33)
T. 11 N.
1 340 000 FEET
410 000 FEET
400 000 FEET
1 365 000 FEET
Scale 1:24000
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

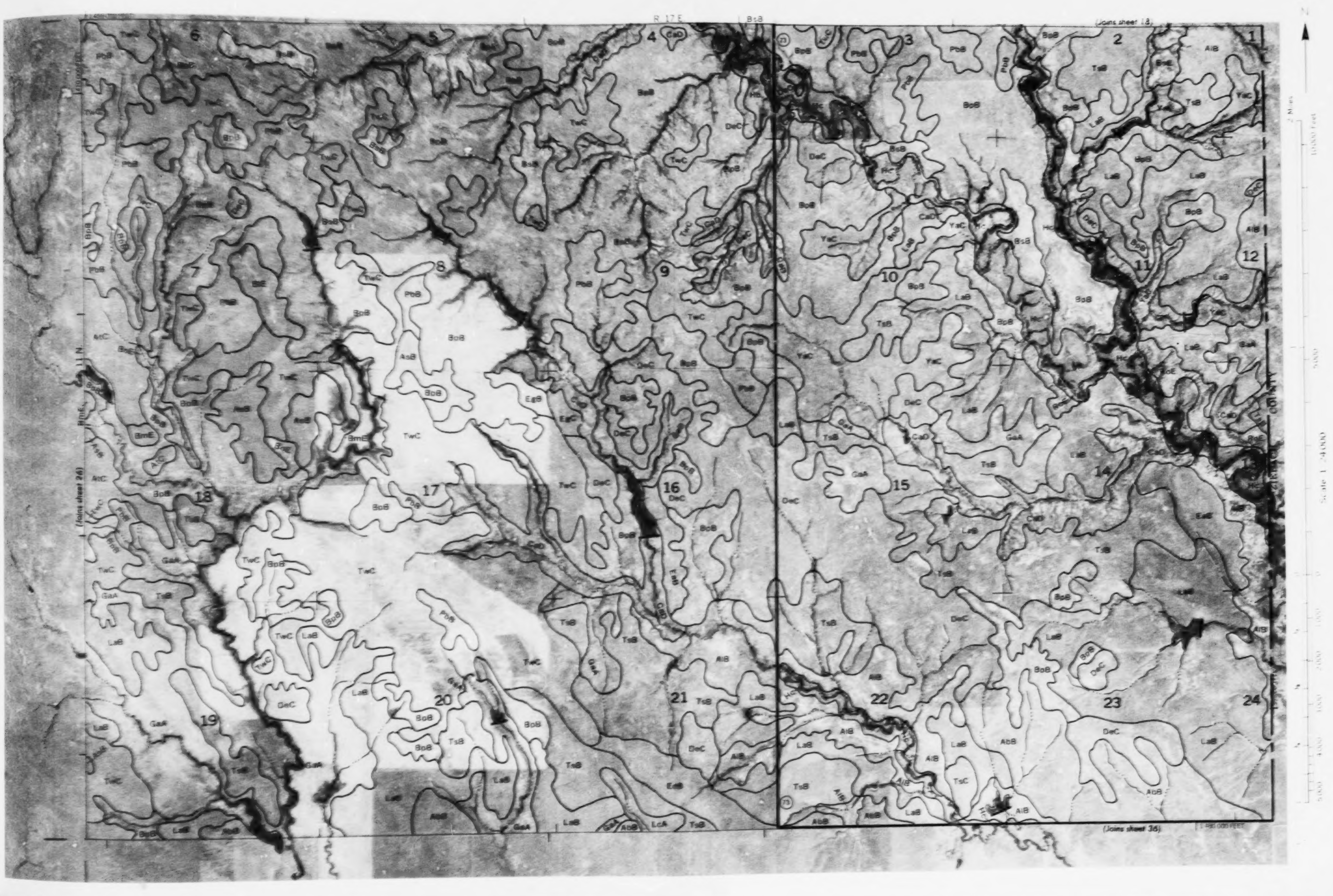
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 24


N
2 Miles
10 000 Feet
5 000
Scale 1:24 000
0
1000
2000
3000
4000
5000
(Joins sheet 15)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 33)
R. 14 E.
R. 15 E.
T. 11 N.
1 356 000 FEET
1 370 000 FEET
400 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

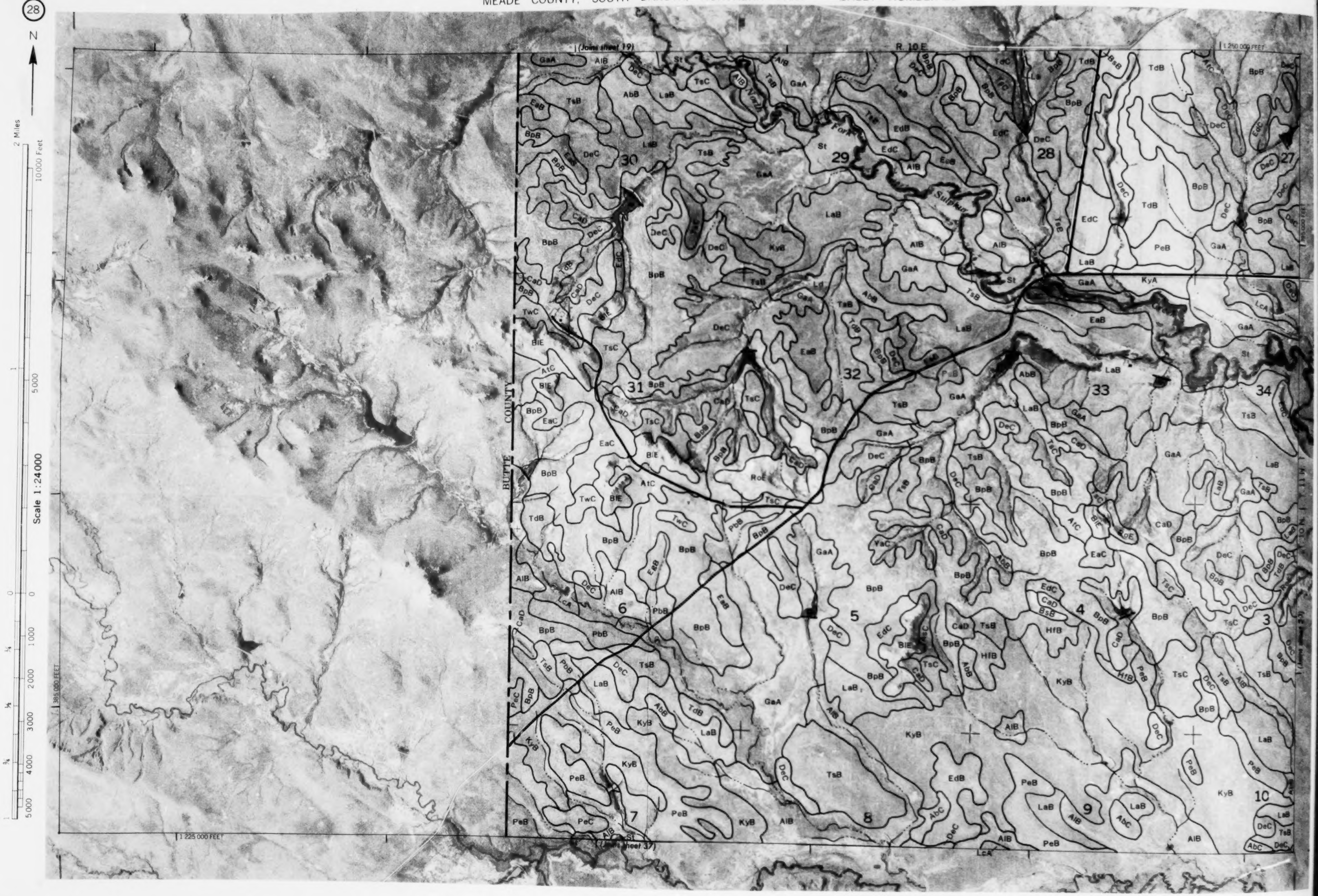

N
(Joins sheet 16)
R. 15 E.
R. 16 E.
1 400 000 FEET
410 000 FEET
T. 11 N.
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 34)
1 425 000 FEET
395 000
2 Miles
10 000 Feet
Scale 1:24 000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 26

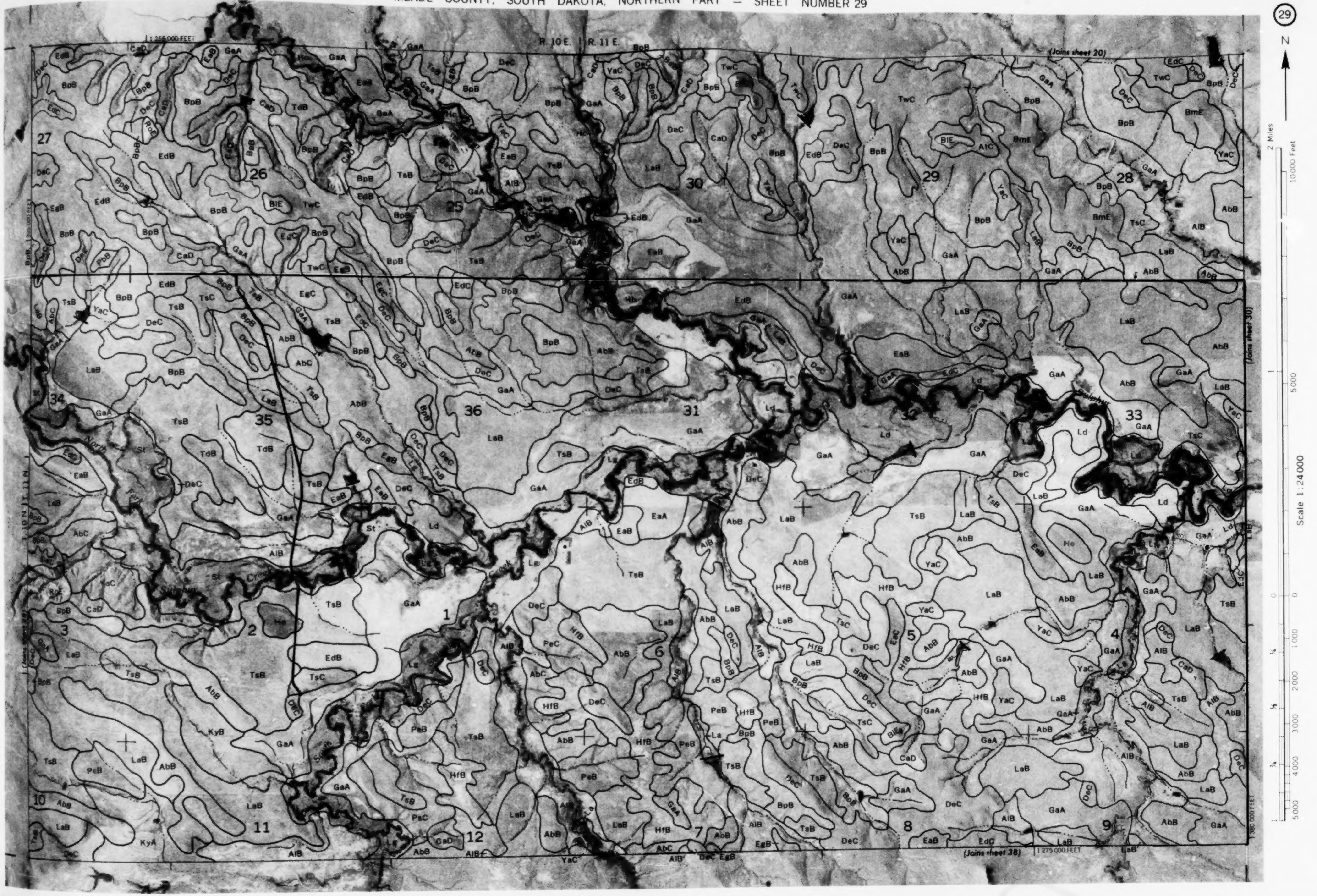

N
2 Miles
10 000 Feet
5000
Scale 1:24000
0
1000
2000
3000
4000
5000
(Joins sheet 17)
R. 16 E.
1 430 000 FEET
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 35)
1 430 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
BpB
TwC
PbB
YaC
GaA
EaB
EgC
BmE
TsB
TsC
DeC
BsB
CaD
LaB
EdC
AsB
BoE
AtC
Hc
AbB
LaB


R. 17 E.
T. 11 N.
(Joins sheet 18)
(Joins sheet 26)
(Joins sheet 36)
N
2 Miles
10000 Feet
5000
0
Scale 1:24000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
73
BpB
PbB
TwC
DeC
TsB
LaB
GaA
AlB
AbB
YaC
BsB
CaD
Hc
BmE
AsB
EgB
LcA
TsC

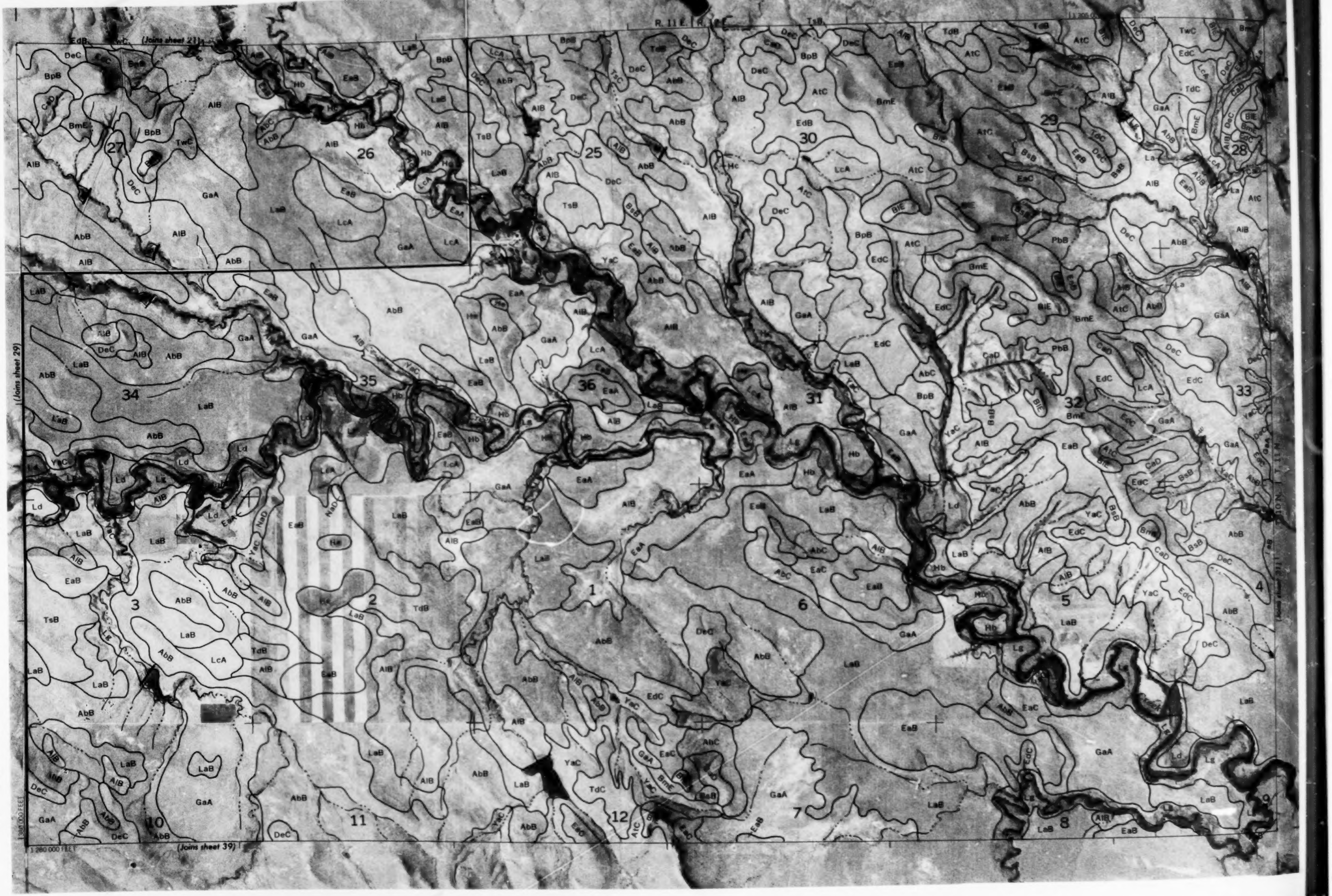
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 28

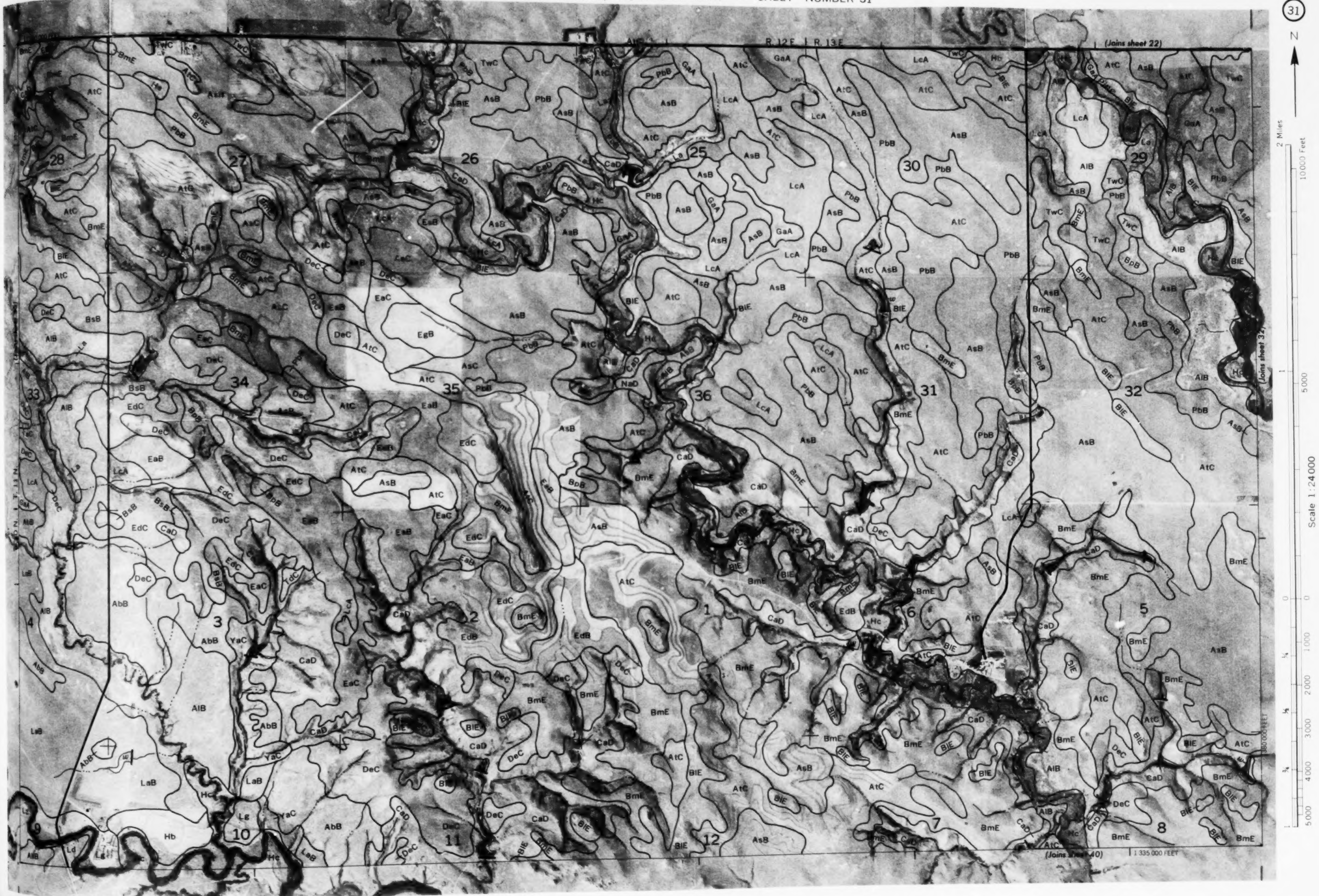

㉘
N
Scale 1:24 000
2 Miles
1
½
¼
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
(Joins sheet 19)
R. 10 E.
1 250 000 FEET
385 000 FEET
1 225 000 FEET
(Joins sheet 37)
BUTTE COUNTY
North
Fork
Sulphur
30
29
28
27
31
32
33
34
6
5
4
3
7
8
9
10

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 29

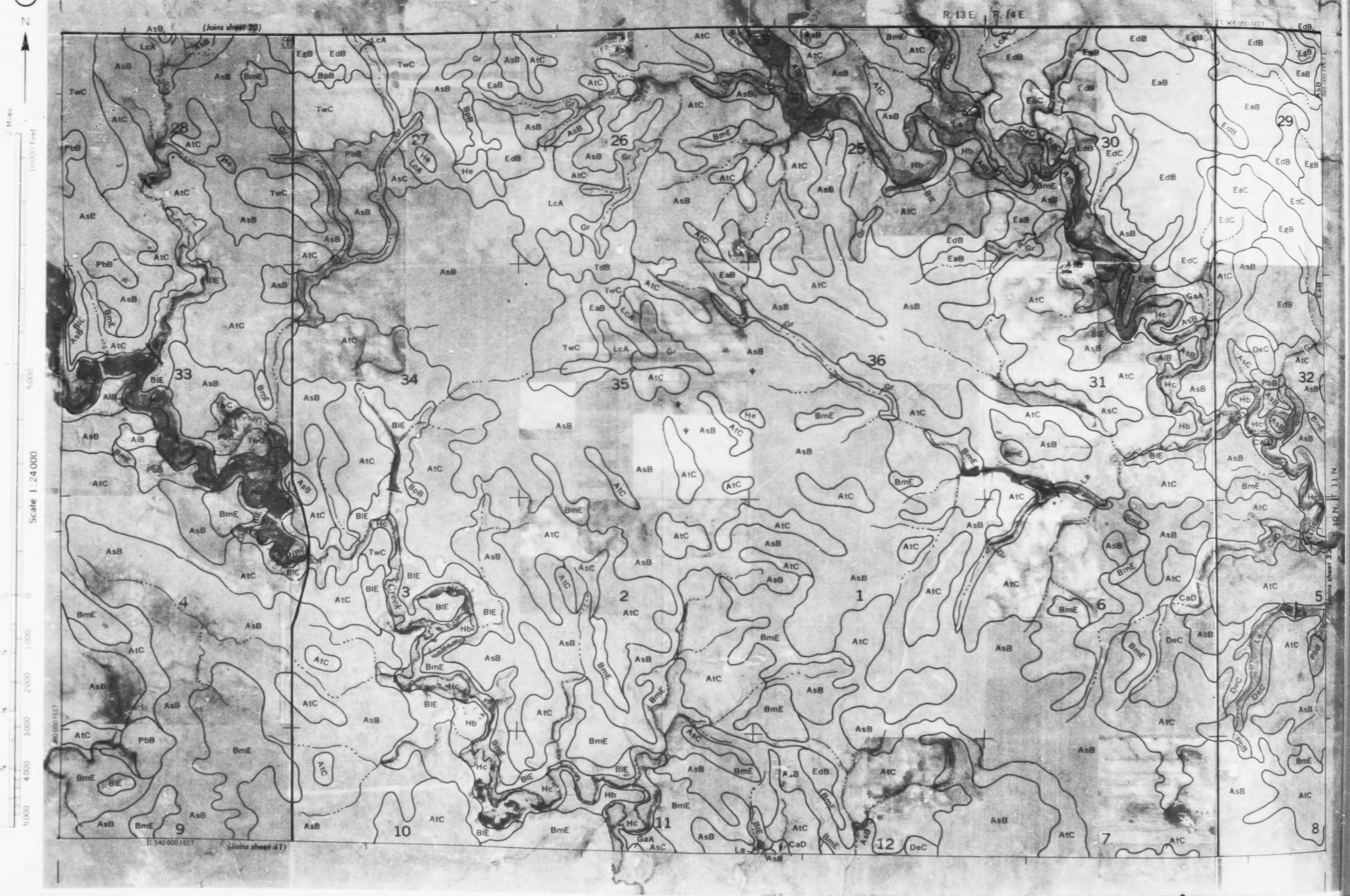

N
R. 10 E. | R. 11 E.
1 255 000 FEET
1 275 000 FEET
(Joins sheet 20)
(Joins sheet 30)
(Joins sheet 38)
T. 10 N. | T. 11 N.
2 Miles
10 000 Feet
Scale 1:24 000
1
5000
0
1000
2000
3000
4000
5000
½
¼
¾
27
26
25
30
29
28
34
35
36
31
32
33
3
2
1
6
5
4
10
11
12
7
8
9
North Fork
Sulphur Creek
South Fork

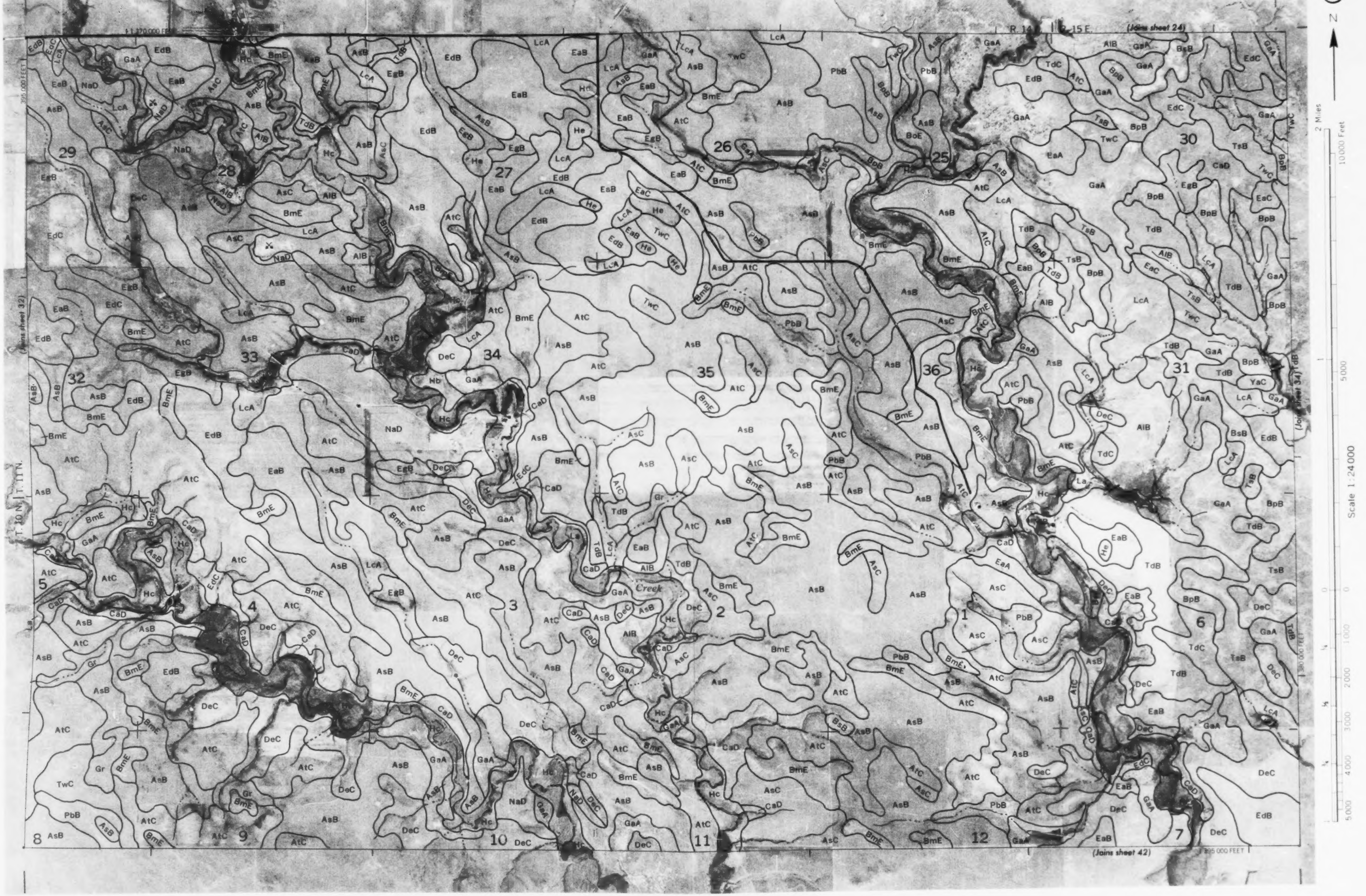
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER


(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 39)
R. 11 E. | R. 12 E.
1 305 000
1 280 000 FEET
Scale 1:24000
10000 Feet
5000
0
1000
2000
3000
4000
5000
30 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
25
26
27
28
29
30
31
32
33
34
35
36
AbB
AbC
AlB
AtC
BlE
BmE
BpB
BsB
CaD
DeC
EaA
EaB
EaC
EdB
EdC
GaA
Hb
Hc
La
LaB
LcA
Ld
Le
Lg
NaD
PbB
TdB
TdC
TsB
TwC
YaC

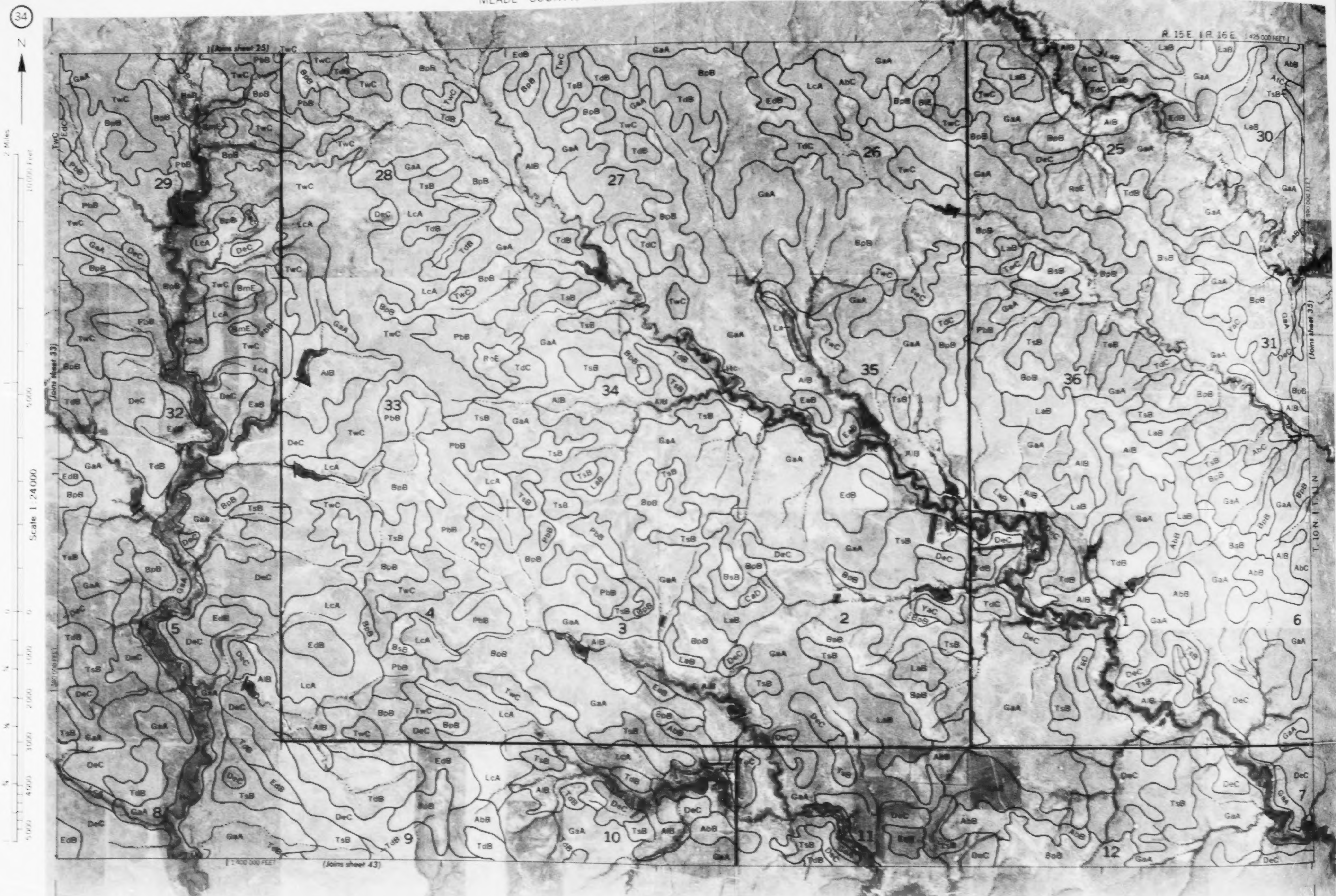

31
N
(Joins sheet 22)
(Joins sheet 32)
(Joins sheet 40)
R. 12 E.
R. 13 E.
T. 11 N.
2 Miles
10 000 Feet
5000
1
0
1000
2000
3000
4000
5000
Scale 1:24 000
1 335 000 FEET
380 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
25
26
27
28
29
30
31
32
33
34
35
36
AbB
AlB
AsB
AsC
AtC
BlE
BmE
BpB
BsB
CaD
DeC
EaB
EaC
EdB
EdC
EgB
GaA
Hb
Hc
La
LaB
LcA
Ld
Lg
NaD
PbB
TwC
YaC

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 32

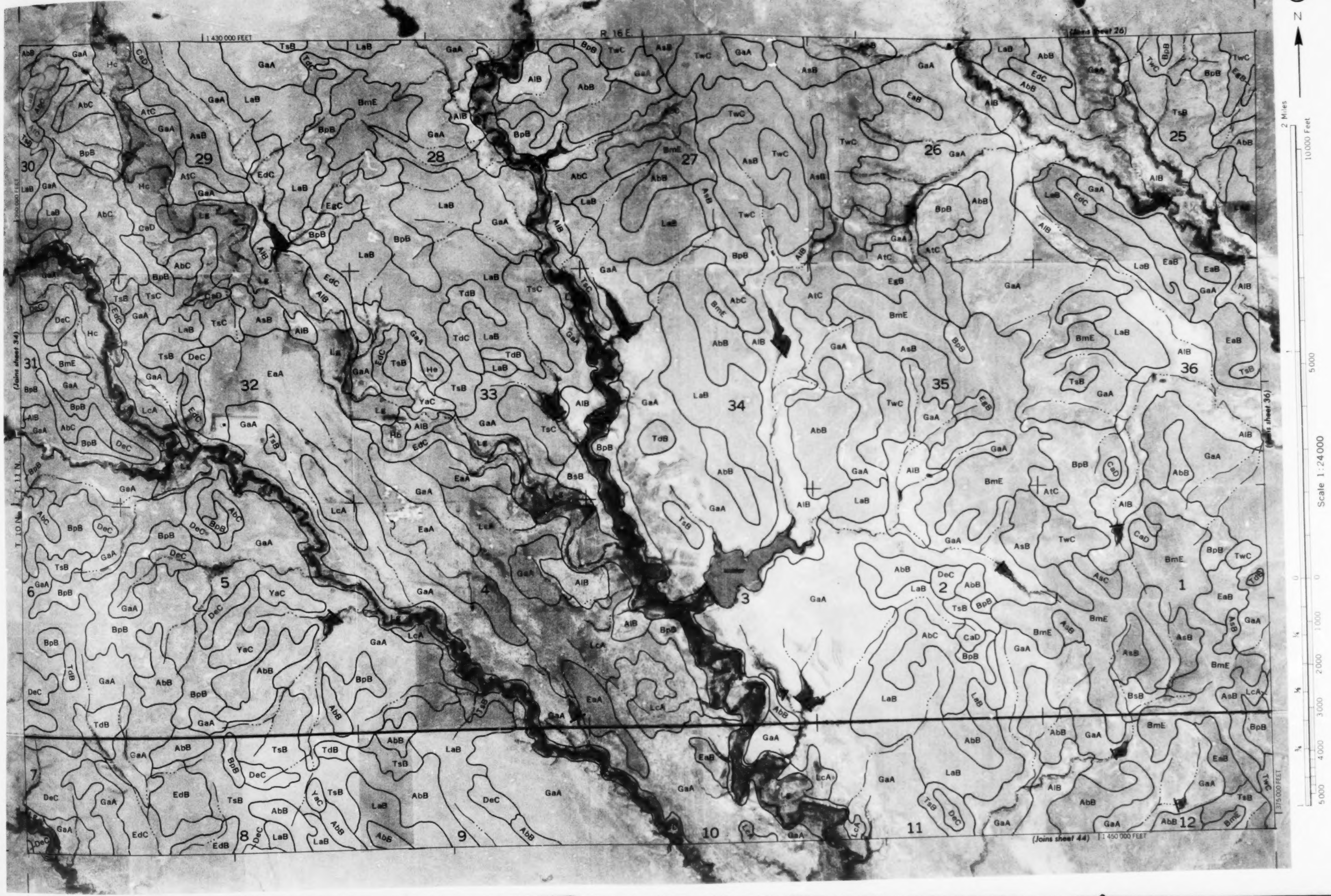

N
Scale 1:24 000
2 Miles
10 000 Feet
5000
0
1000
2000
3000
4000
5000
(Joins sheet 23)
(Joins sheet 41)
Joins sheet 33
R. 13 E.
R. 14 E.
T. 11 N.
T. 10 N.
1 355 000 FEET
385 000 FEET
1 340 000 FEET
40 000 FEET
28
27
26
25
30
29
33
34
35
36
31
32
4
3
2
1
6
5
9
10
11
12
7
8
Creek
AsB
AsC
AtC
AlB
BlE
BmE
BpB
CaD
DeC
EaB
EaC
EdB
EdC
EgB
GaA
Gr
Hb
Hc
He
La
LcA
PbB
TdB
TwC

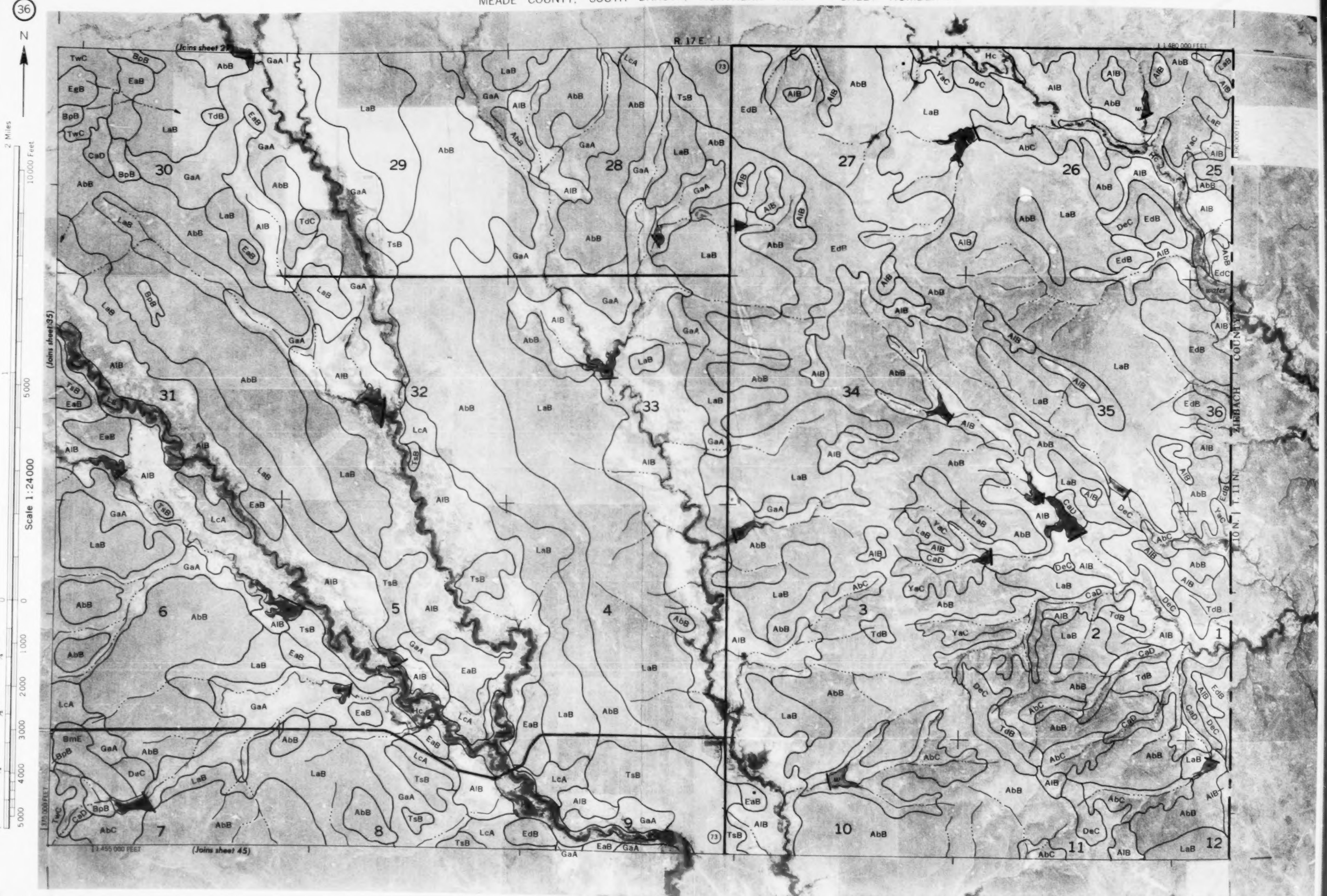

(Joins sheet 24)
R. 14 E. | R. 15 E.
1 370 000 FEET
395 000 FEET
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 42)
1 395 000 FEET
380 000 FEET
T. 10 N. | T. 11 N.
N
2 Miles
10000 Feet
5000
1
0
Scale 1:24000
Creek
29
28
27
26
25
30
32
33
34
35
36
31
5
4
3
2
1
6
8
9
10
11
12
7

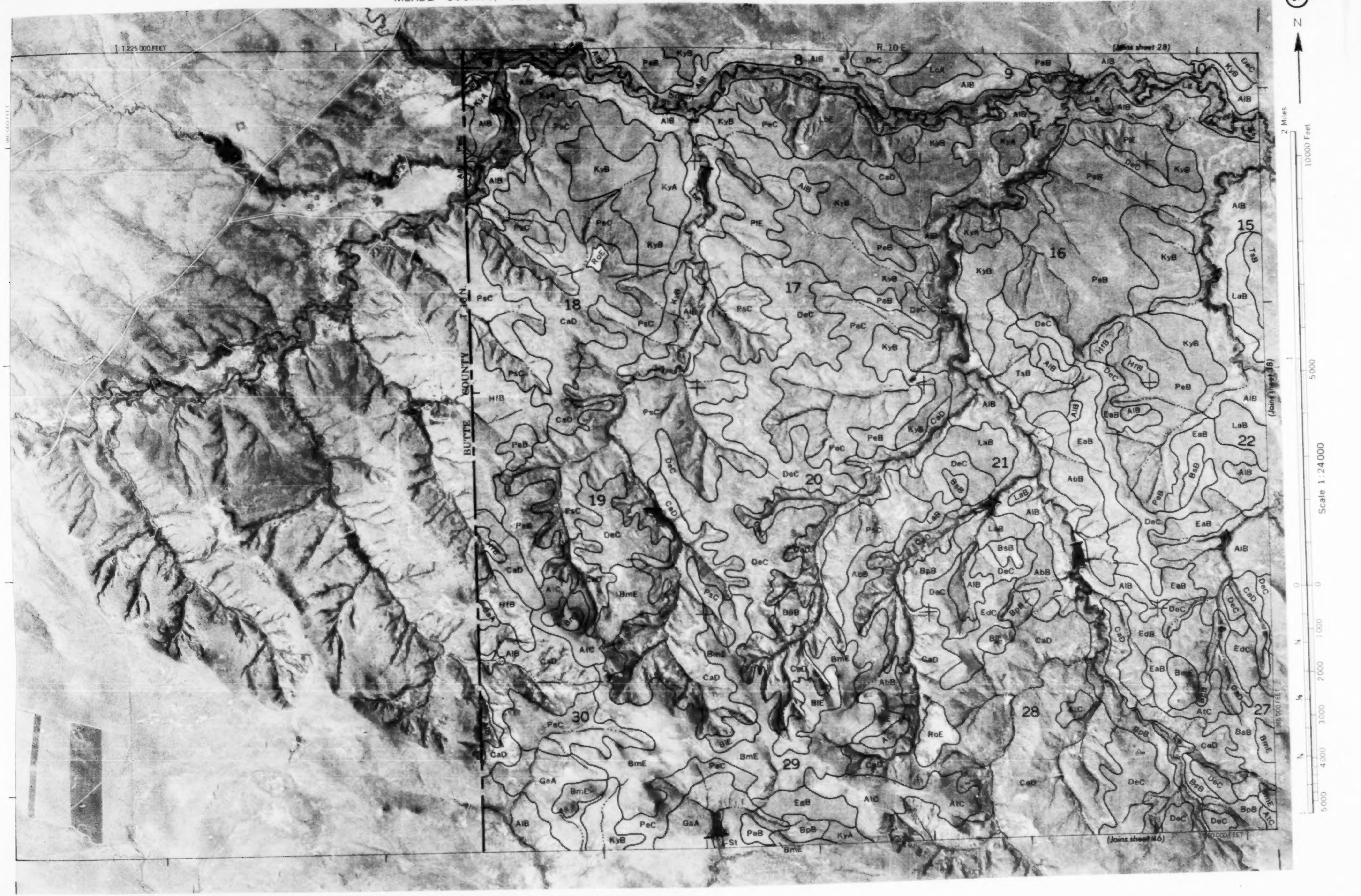
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 34

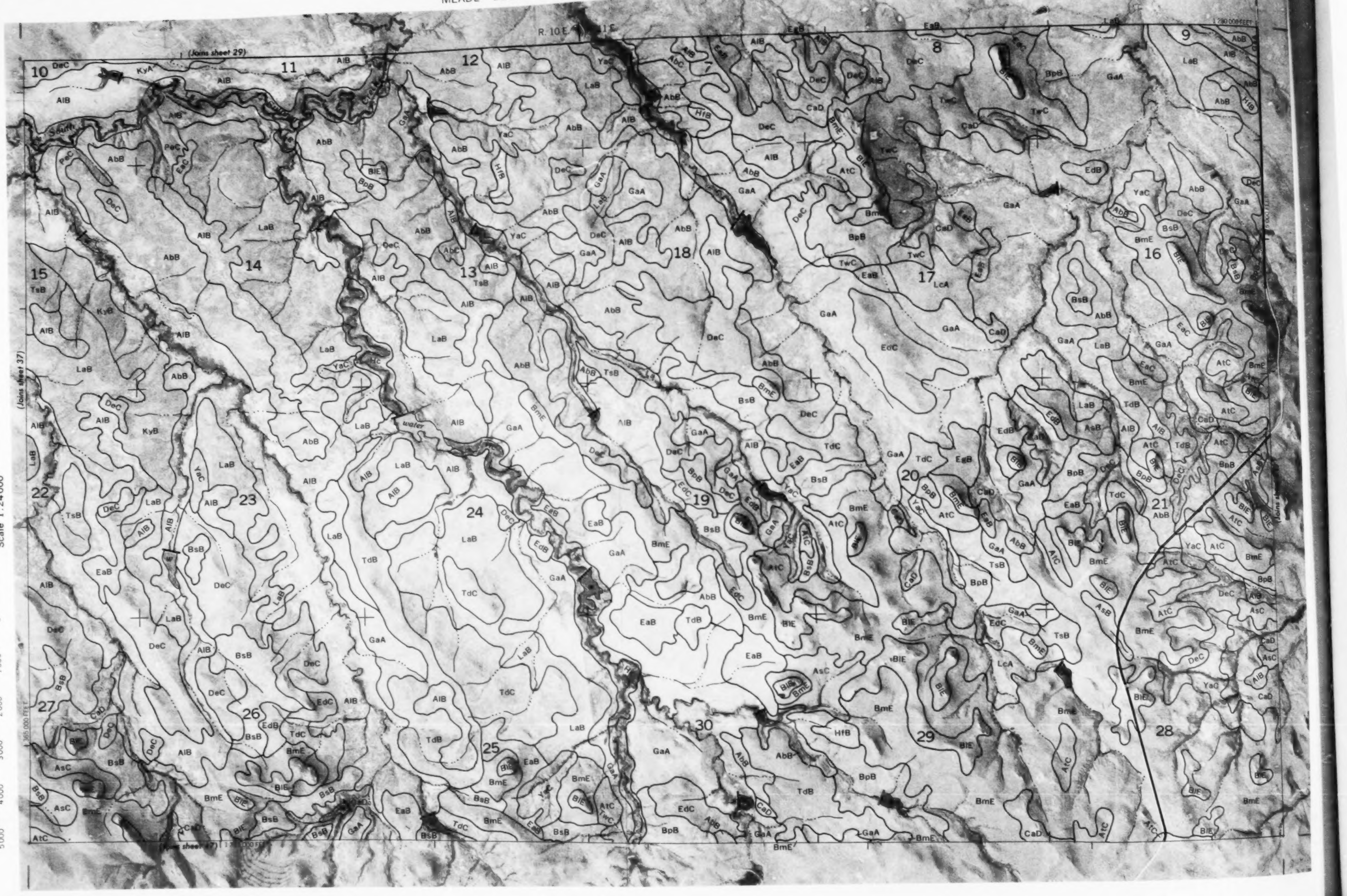

34
N
2 Miles
Scale 1:24000
(Joins sheet 25)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 43)
R. 15 E. | R. 16 E.
T. 10 N. | T. 11 N.
425 000 FEET
1 400 000 FEET
29
28
27
26
25
30
32
33
34
35
36
31
5
4
3
2
1
6
8
9
10
11
12
7

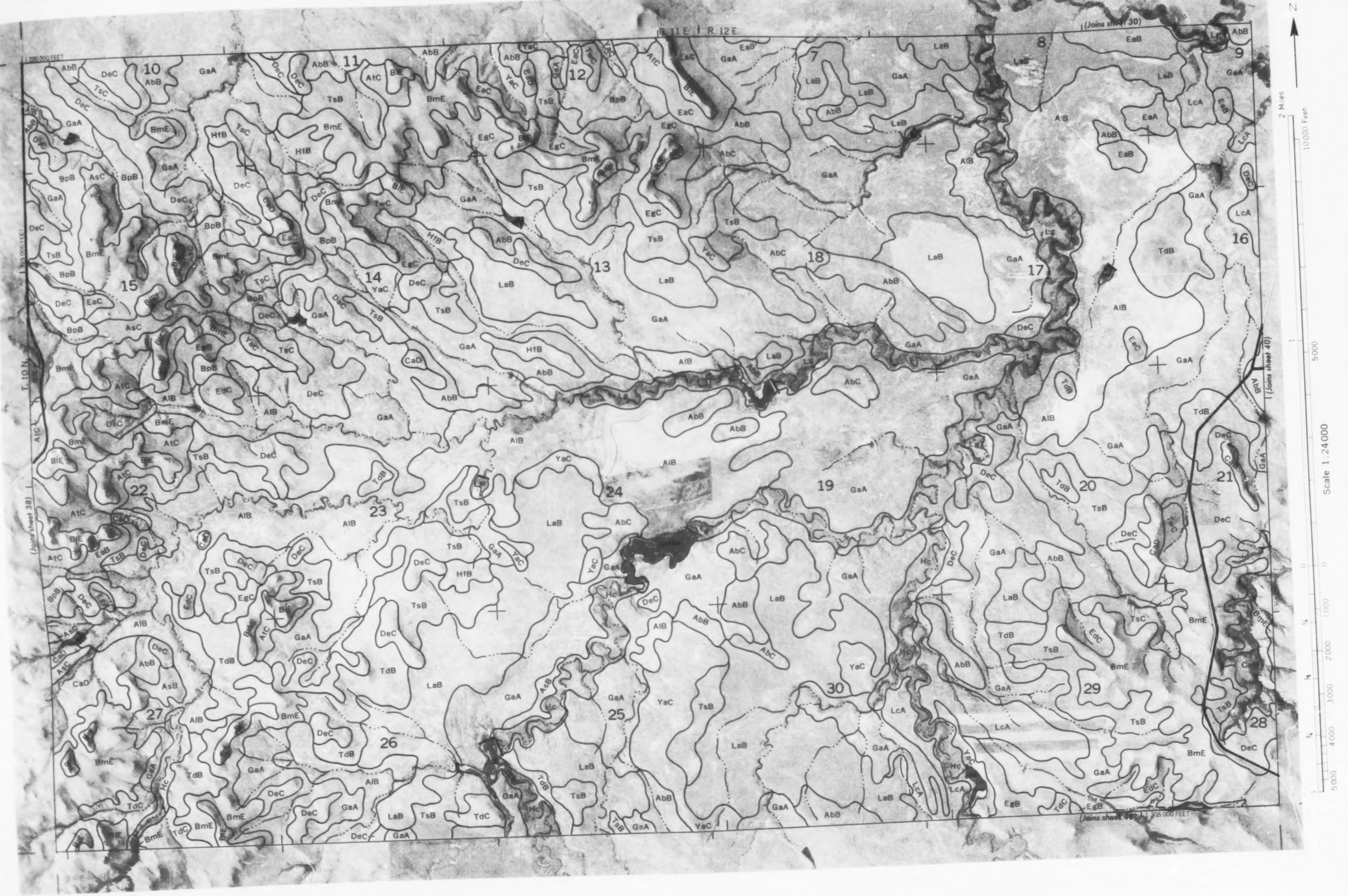
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 35

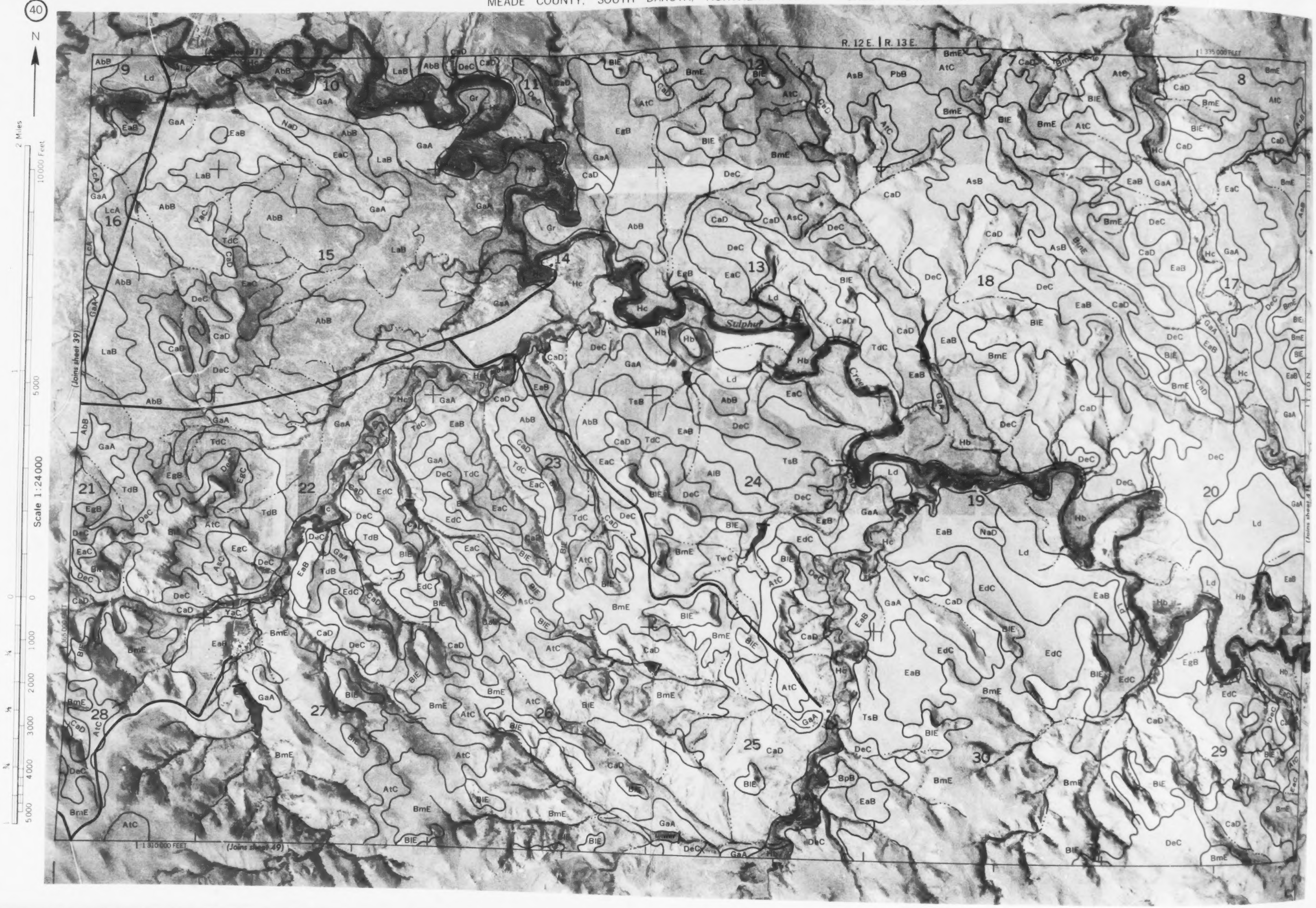

N
1 430 000 FEET
R. 16 E.
(Joins sheet 26)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 44)
1 450 000 FEET
375 000 FEET
T. 10 N.
T. 11 N.
2 Miles
10000 Feet
5000
0
1
Scale 1:24000
1000
2000
3000
4000
5000
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
AbB
AbC
AlB
AsB
AsC
AtC
BmE
BpB
BsB
CaD
DeC
EaA
EaB
EdB
EdC
EgB
EgC
GaA
Hb
Hc
He
La
LaB
Ls
LcA
TdB
TdC
TsB
TsC
TwC
YaC


(36)
N
2 Miles
10 000 Feet
5000
Scale 1:24 000
(Joins sheet 27)
(Joins sheet 35)
(Joins sheet 45)
R. 17 E.
1 480 000 FEET
1 455 000 FEET
ZIEBACH COUNTY
T. 10 N. | T. 11 N.
73
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12
AbB
AlB
LaB
GaA
EaB
TsB
LcA
BpB
TwC
EgB
CaD
TdB
TdC
EdB
EdC
DeC
YaC
AbC
Hc
BmE
DaC
CaD
water

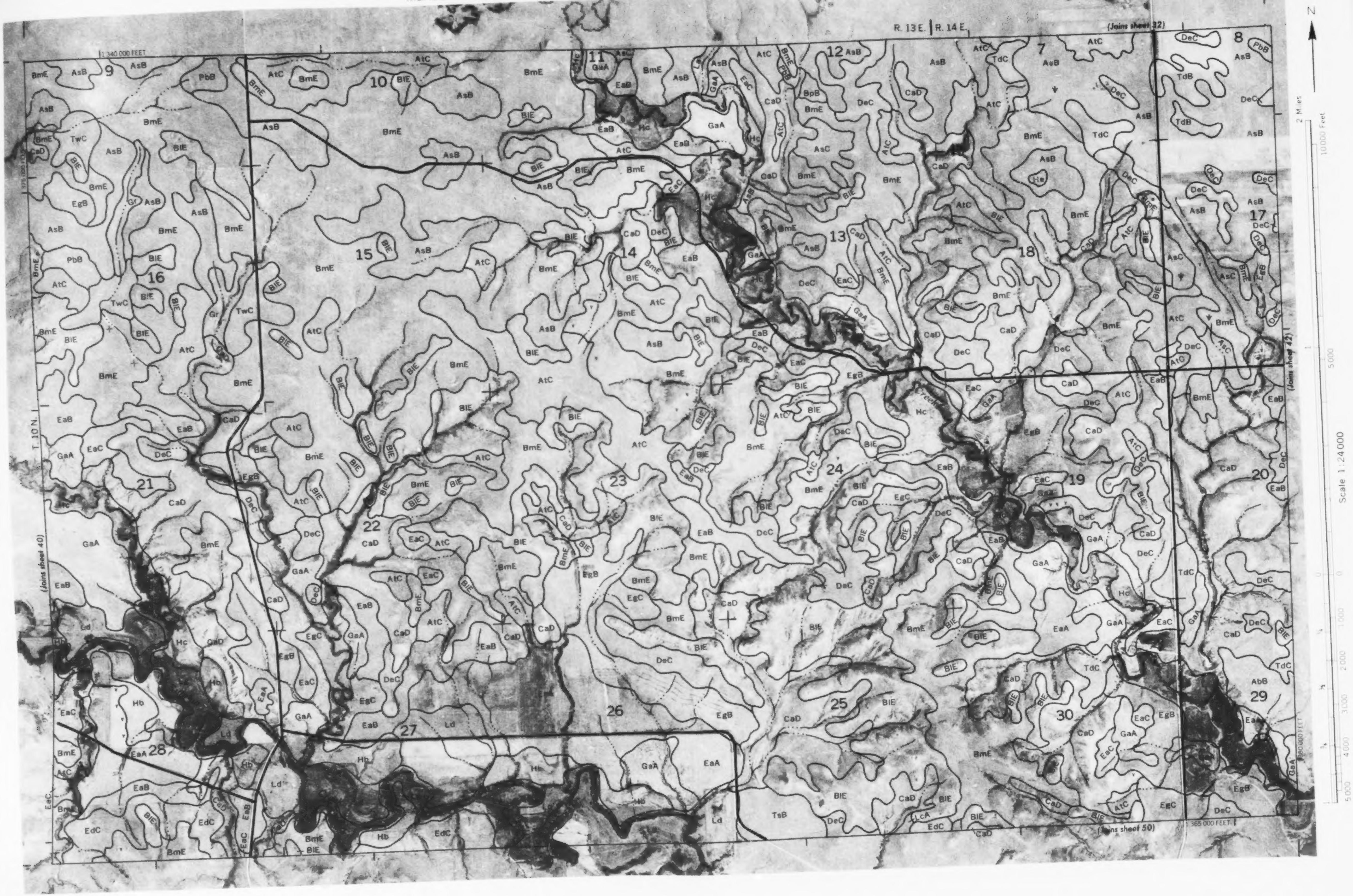

1 225 000 FEET
R. 10 E.
(Joins sheet 28)
(Joins sheet 36)
(Joins sheet 46)
T. 10 N.
BUTTE COUNTY
N
2 Miles
10 000 Feet
5000
0
¼
½
¾
1000
2000
3000
4000
5000
Scale 1:24 000
7
8
9
10
15
16
17
18
19
20
21
22
27
28
29
30
AlB
KyB
KyA
PeB
PeC
PsC
DeC
LoA
LoE
Le
St
CaD
PlE
RoE
HfB
TsB
LaB
EaB
EdB
EdC
AbB
BsB
BpB
BmE
BlE
BlB
AtC
GaA
EgB


N
2 Miles
10 000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24 000
(Joins sheet 29)
(Joins sheet 37)
(Joins sheet 47)
Joins sheet
R. 10 E.
R. 11 E.
1 280 000 FEET
1 365 000 FEET
1 300 000 FEET
South
water
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
AbB
AlB
AsB
AsC
AtC
BlE
BmE
BpB
BsB
CaD
DeC
EaB
EaC
EdB
EdC
GaA
HfB
KyA
KyB
LaB
LcA
PeC
TdB
TdC
TsB
TwC
YaC

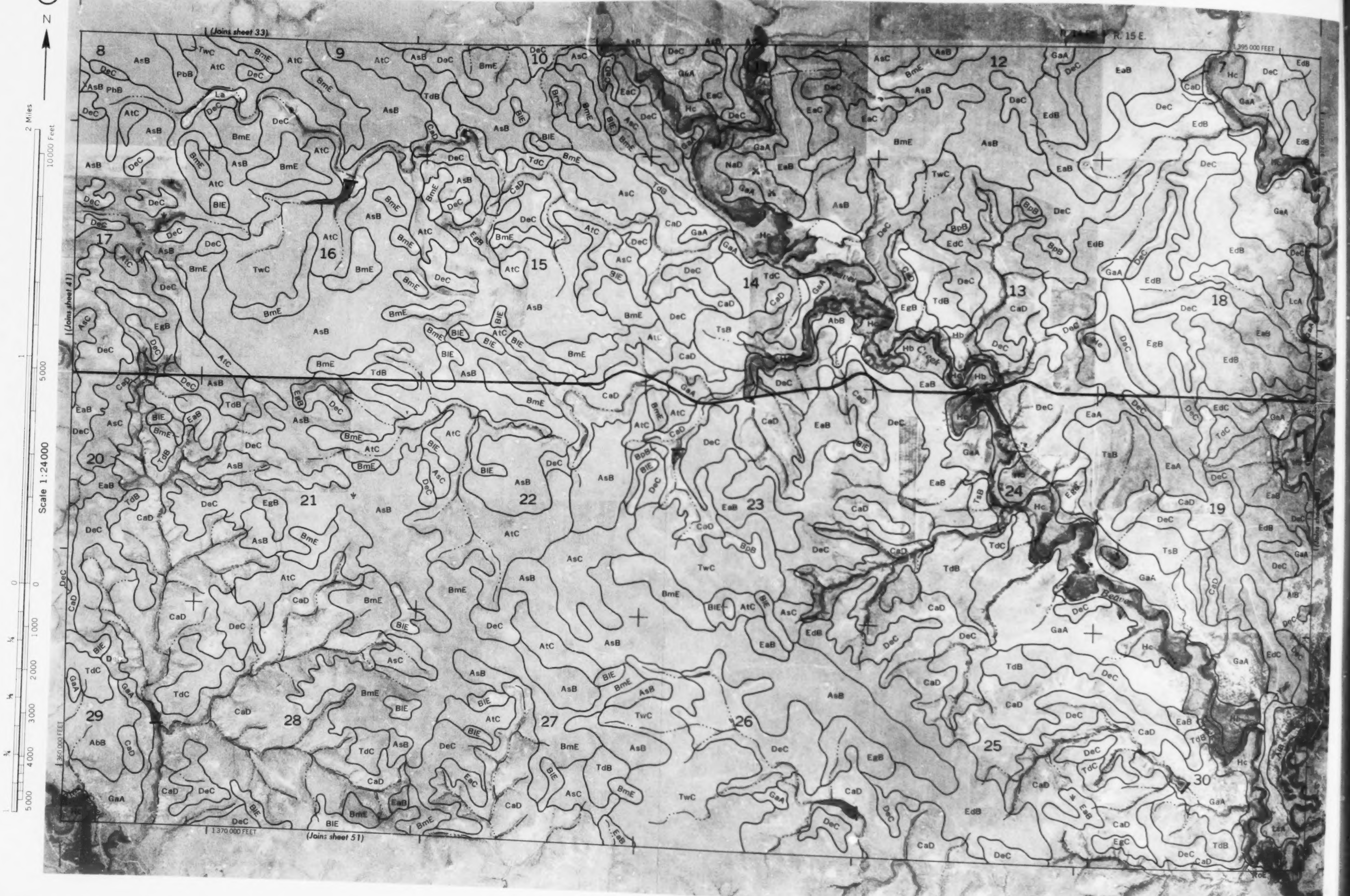

N
(Joins sheet 30)
R. 11 E.
R. 12 E.
T. 10 N.
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 48)
280 000 FEET
305 000 FEET
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24 000

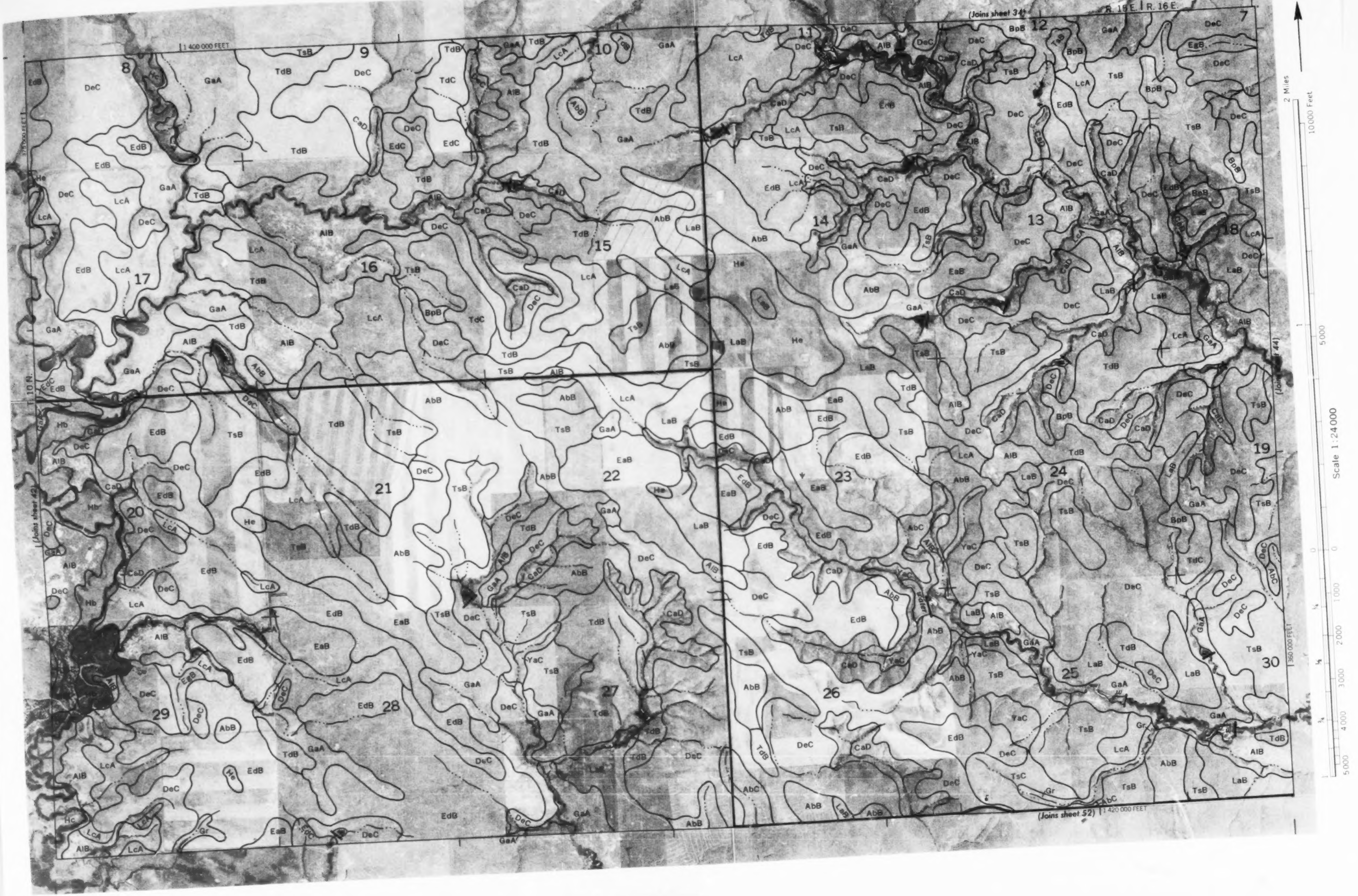

40
N
2 Miles
10 000 Feet
5000
1
0
Scale 1:24 000
0
1000
2000
3000
4000
5000
¼
½
¾
R. 12 E. | R. 13 E.
1 335 000 FEET
(Joins sheet 31)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 49)
1 310 000 FEET
365 000 FEET
T. 10 N.
Sulphur Creek
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
AbB
AlB
AsB
AsC
AtC
BlE
BmE
BpB
CaD
DeC
EaB
EaC
EdC
EgB
EgC
GaA
Gr
Hb
Hc
LaB
LcA
Ld
NaD
PbB
TdB
TdC
TsB
TwC
YaC

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 41

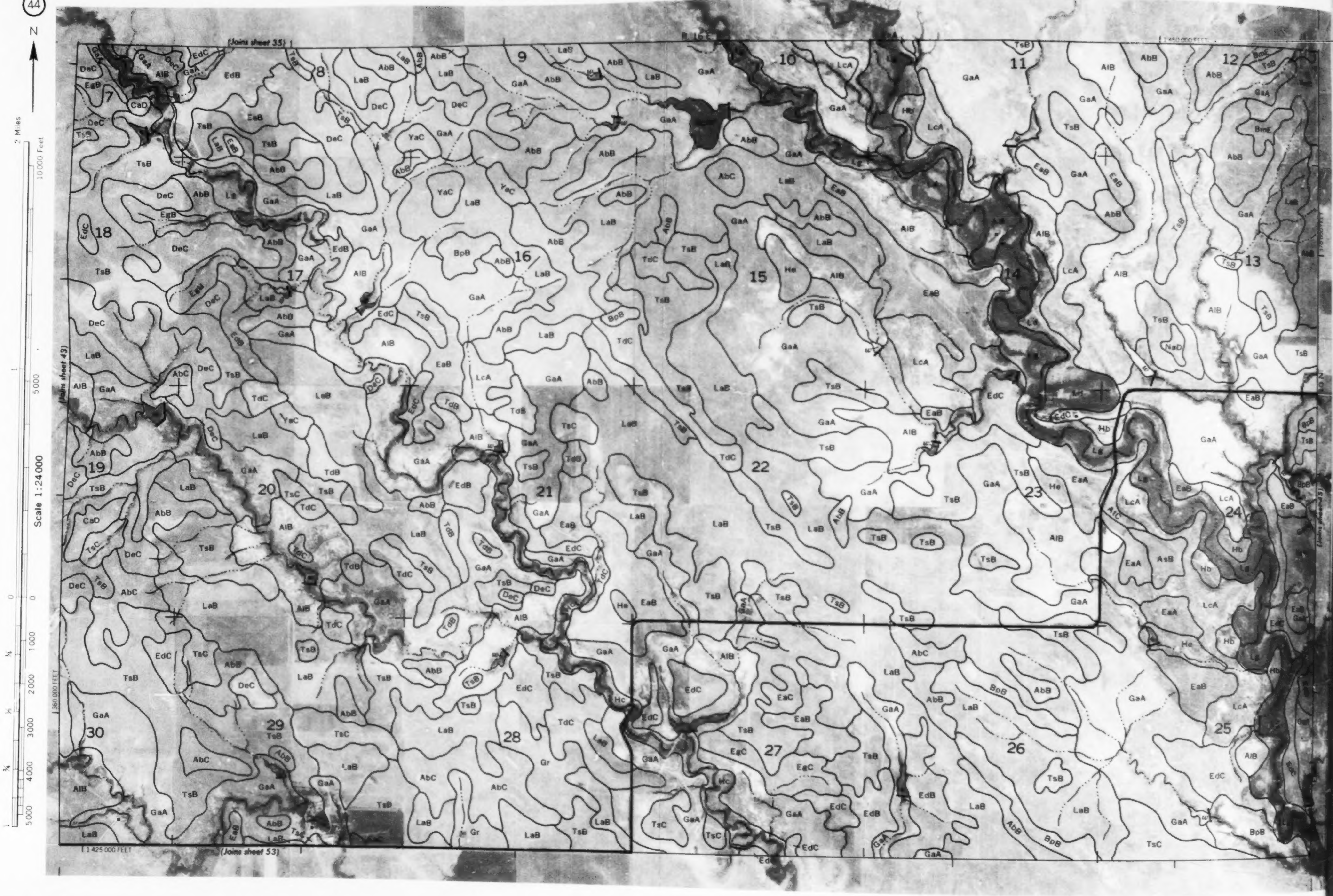

(Joins sheet 32)
(Joins sheet 42)
(Joins sheet 50)
(Joins sheet 40)
R. 13 E.
R. 14 E.
T. 10 N.
N
1 340 000 FEET
1 365 000 FEET
375 000 FEET
350 000 FEET
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
AbB
AsB
AsC
AtC
BIE
BmE
BpB
CaD
DeC
EaA
EaB
EaC
EdC
EgB
EgC
GaA
Gr
Hb
Hc
He
LcA
Ld
PbB
TdB
TdC
TsB
TwC

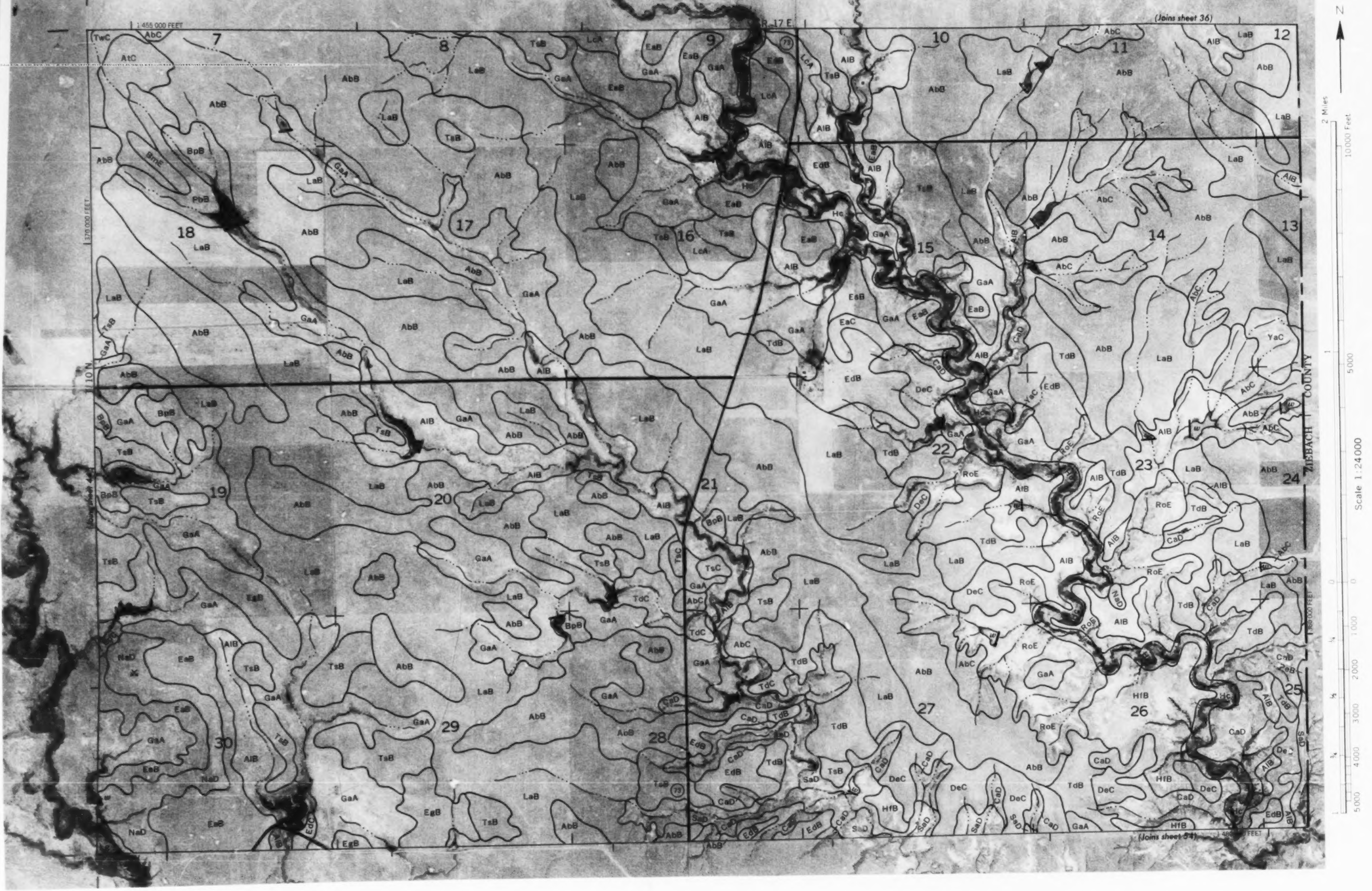
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 42

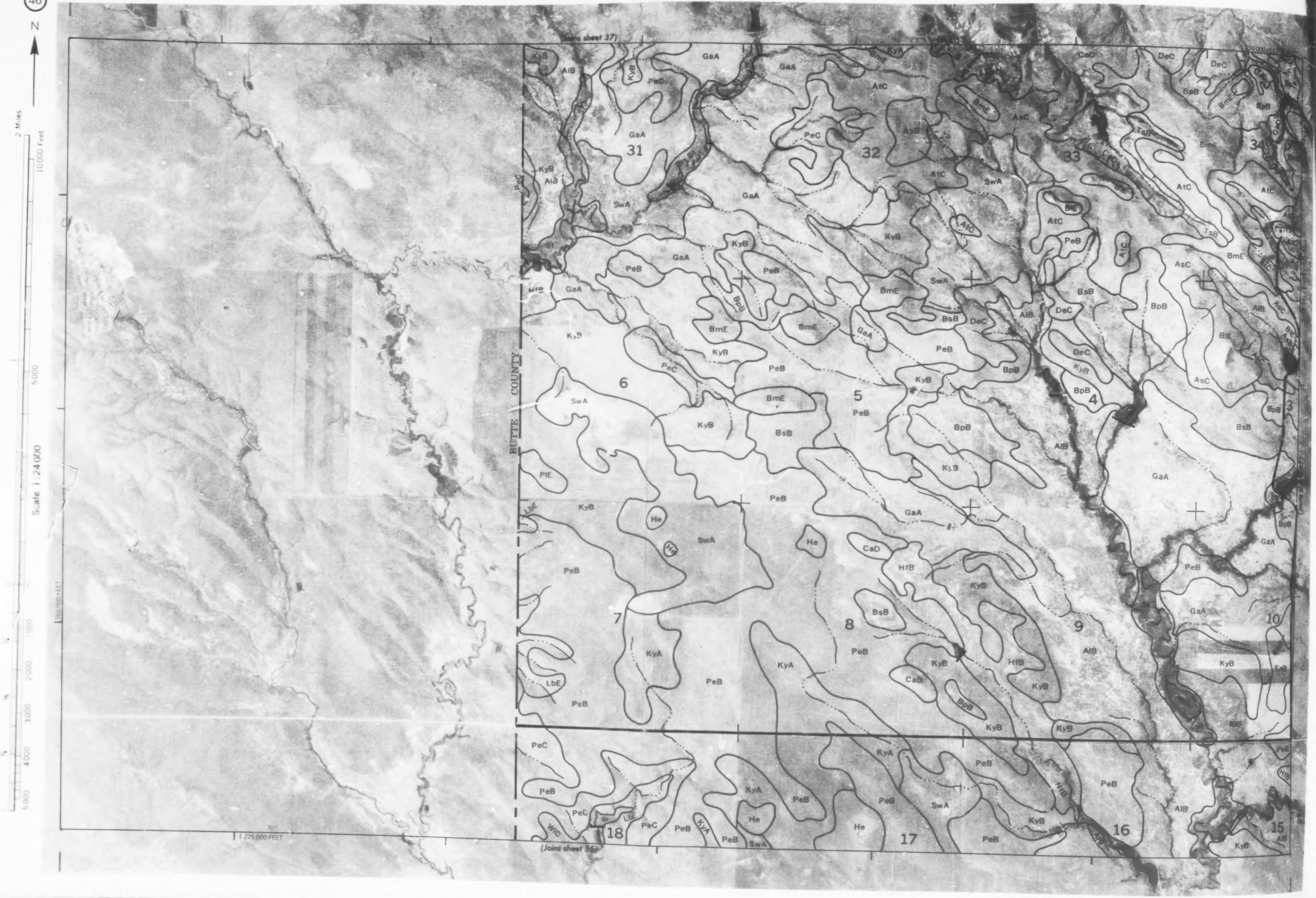

N
2 Miles
10 000 Feet
5000
Scale 1:24 000
0
1000
2000
3000
4000
5000
(Joins sheet 33)
(Joins sheet 41)
(Joins sheet 51)
R. 14 E. | R. 15 E.
1 395 000 FEET
1 370 000 FEET
360 000 FEET
Beaver Creek
8
9
10
12
7
17
16
15
14
13
18
20
21
22
23
24
19
29
28
27
26
25
30
AsB
AtC
BmE
DeC
TwC
PbB
La
BlE
TdB
TdC
CaD
AsC
EaC
GaA
Hc
Hb
NaD
EaB
EdB
EdC
BpB
EgB
TsB
AbB
EaA
LcA
EcC
EsC


(Joins sheet 34)
R. 15 E.
R. 16 E.
1 400 000 FEET
T. 10 N.
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 52)
1 420 000 FEET
360 000 FEET
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
DeC
EdB
GaA
TdB
TsB
LcA
AlB
AbB
CaD
LaB
He
Hb
Hc
BpB
TdC
EdC
EaB
YaC
AbC
TsC
Gr
2 Miles
10 000 Feet
5000
1
0
1000
2000
3000
4000
5000
Scale 1:24 000

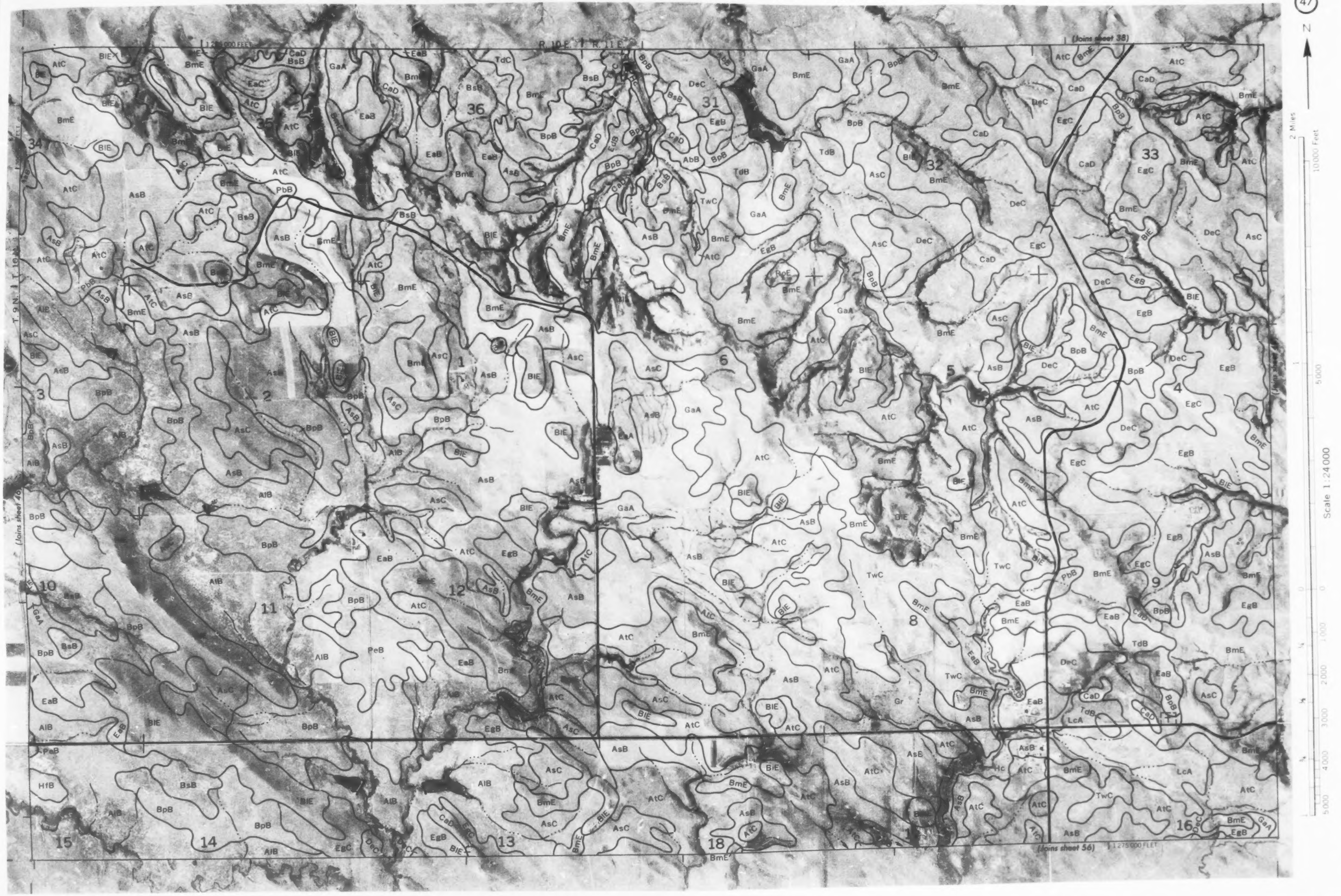
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 44


N
2 Miles
10000 Feet
Scale 1:24 000
(Joins sheet 35)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 53)
R. 16 E.
1 650 000 FEET
1 425 000 FEET
360 000 FEET
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

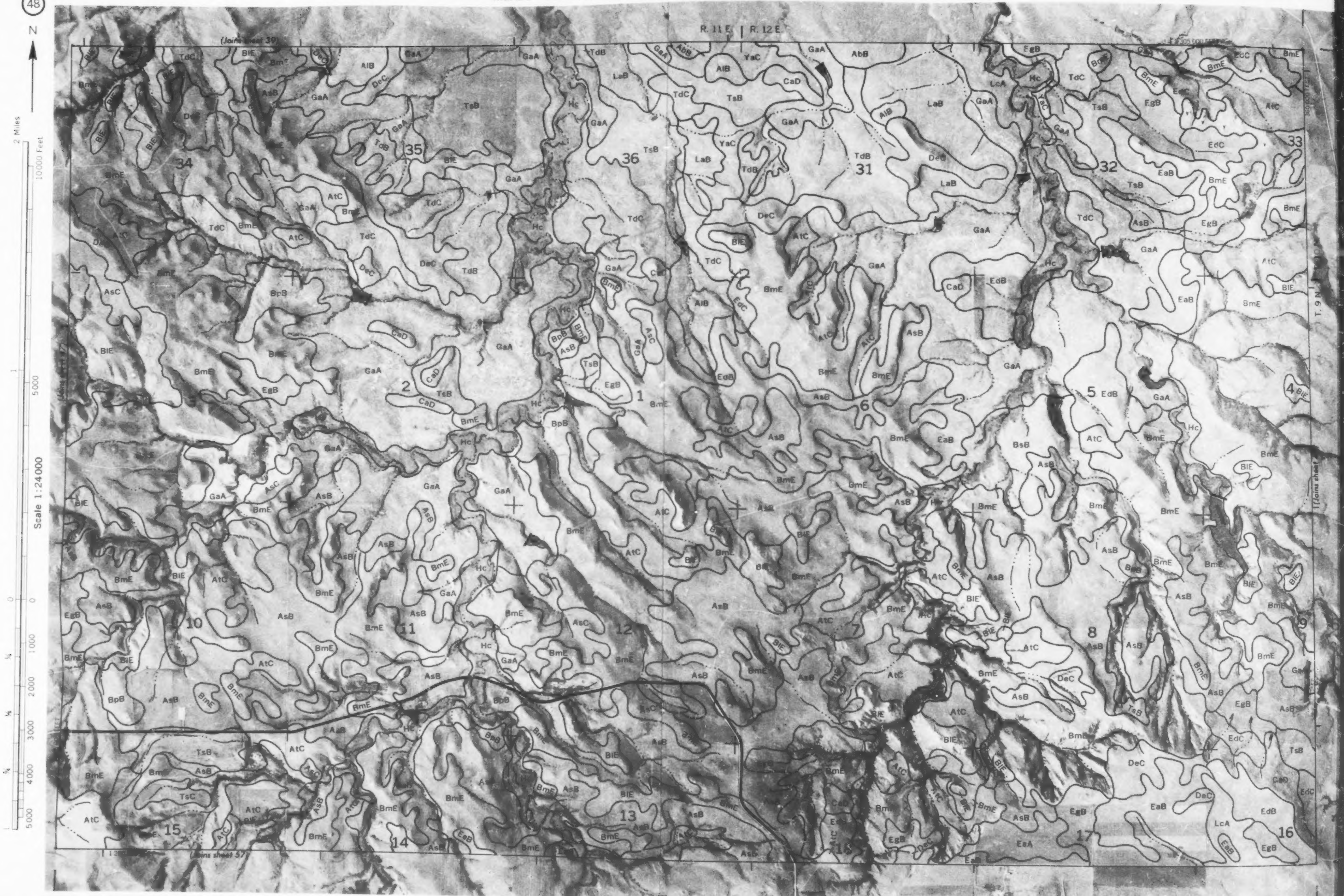
1 455 000 FEET
R. 17 E.
(Joins sheet 36)
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
370 000 FEET
T. 10 N.
ZIEBACH COUNTY
(Joins sheet 54)
N
2 Miles
10 000 Feet
Scale 1:24 000
AbB
AbC
AlB
AtC
BmE
BpB
CaD
DeC
EaB
EaC
EdB
GaA
Hc
HfB
LaB
LcA
NaD
RoE
SaD
TdB
TdC
TsB
TsC
TwC
YaC
73

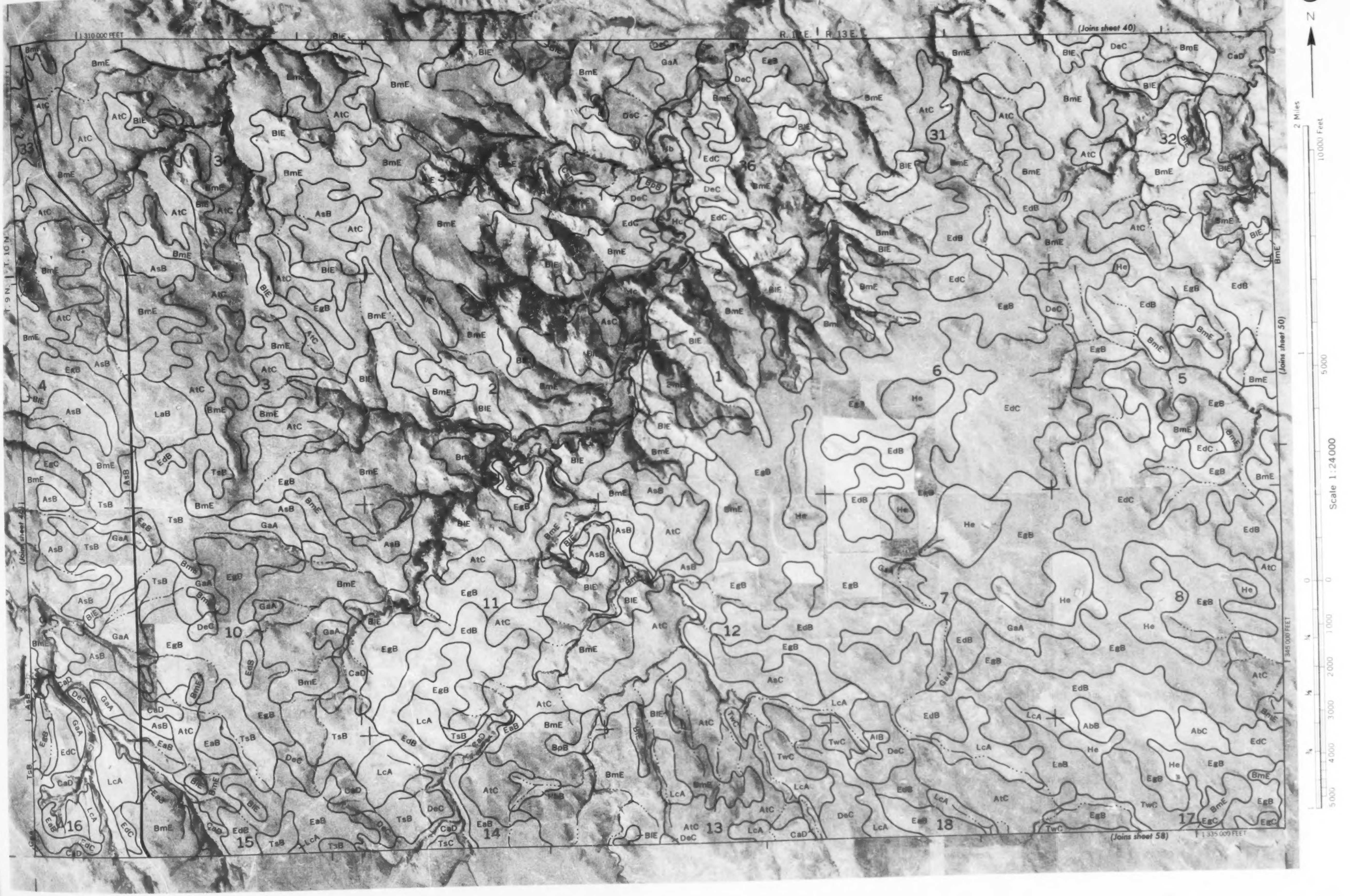

N
2 Miles
10 000 Feet
5000
0
Scale 1:24 000
1000
2000
3000
4000
5000
(Joins sheet 37)
(Joins sheet 56)
BUTTE COUNTY
1 225 000 FEET
31
32
33
34
6
5
4
3
7
8
9
10
18
17
16
15
GaA
KyB
AlB
PeC
SwA
St
AtC
AsB
BmE
AsC
CaD
DeC
BpB
TsB
BlE
PeB
HfB
BsB
BmE
KyA
He
CaD
CaB
PlE
LbE
WlC
FaB

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 47

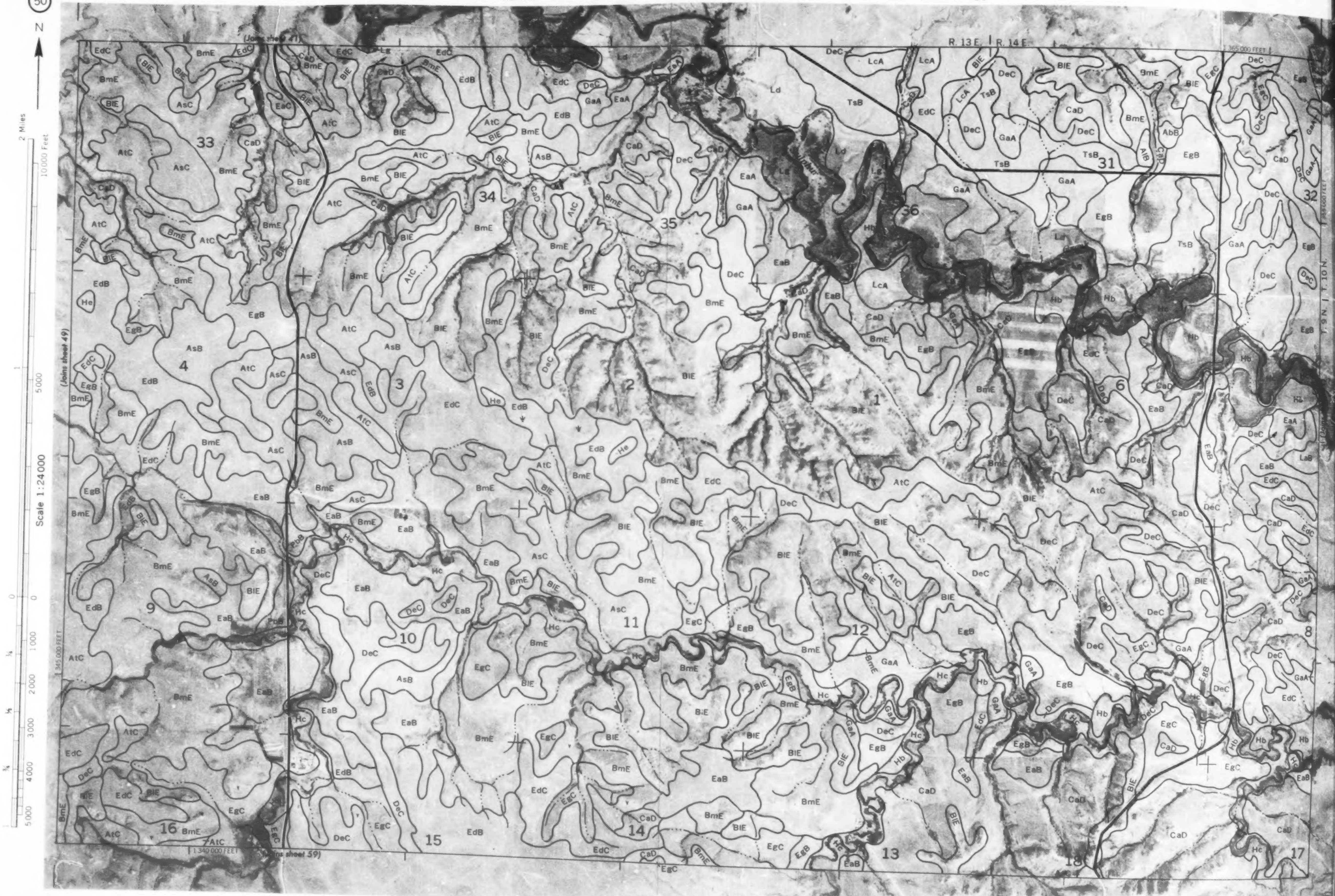

1 250 000 FEET
R. 10 E. | R. 11 E.
(Joins sheet 38)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 56)
1 275 000 FEET
T. 9 N. | T. 10 N.
N
2 Miles
10000 Feet
1
5000
0
Scale 1:24000
1000
2000
3000
4000
5000
34
35
36
31
32
33
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
18
AtC
AsB
AsC
AlB
AbB
BmE
BlE
BpB
BsB
CaD
DeC
EaB
EaC
EdB
EgB
EgC
GaA
Gr
Hc
HfB
LcA
PbB
PeB
TdB
TdC
TwC

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 48

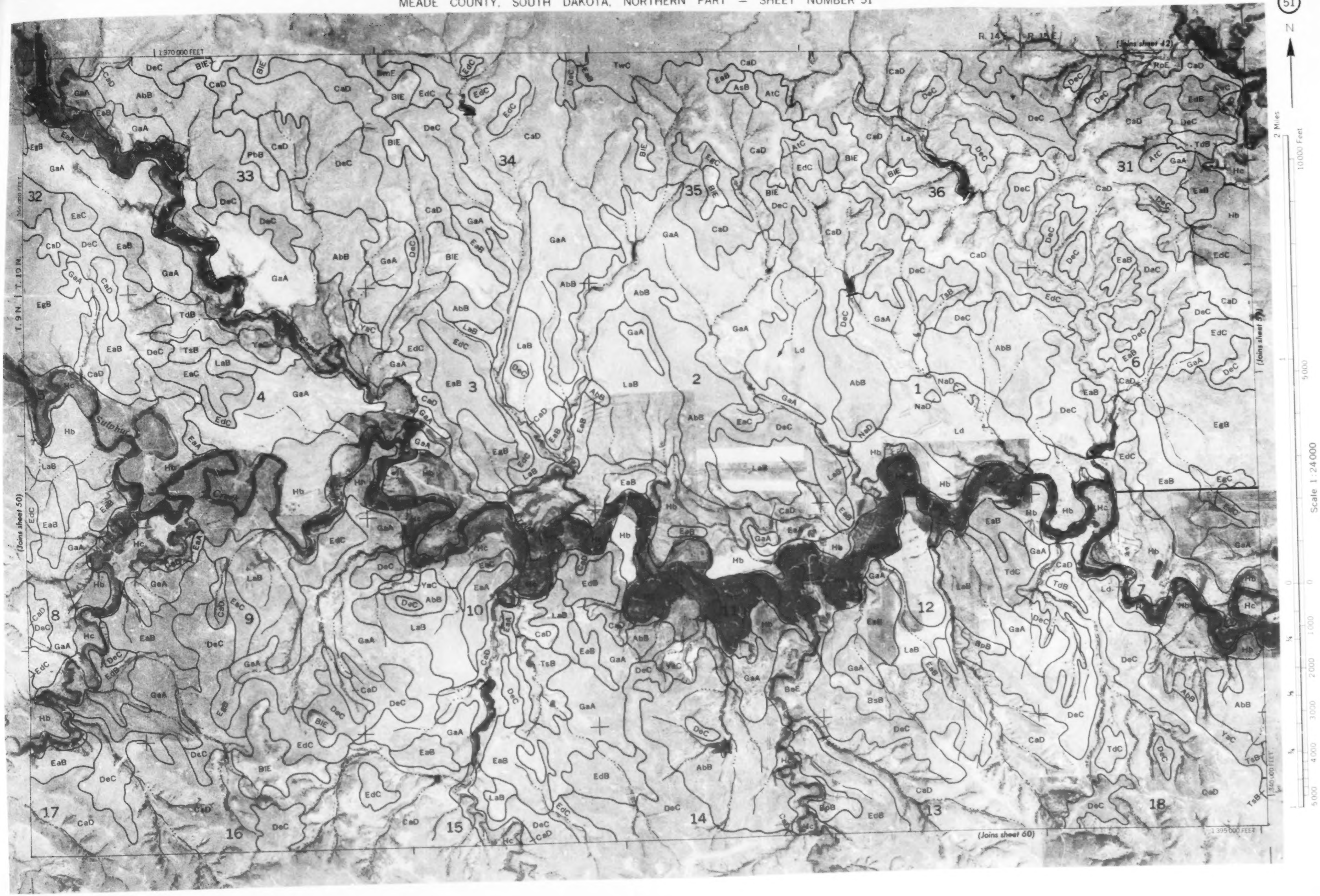

N
2 Miles
10 000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
(Joins sheet 39)
R. 11 E.
R. 12 E.
T. 9 N.
(Joins sheet 57)
(Joins sheet
(Joins sheet 47)
34
35
36
31
32
33
1
2
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

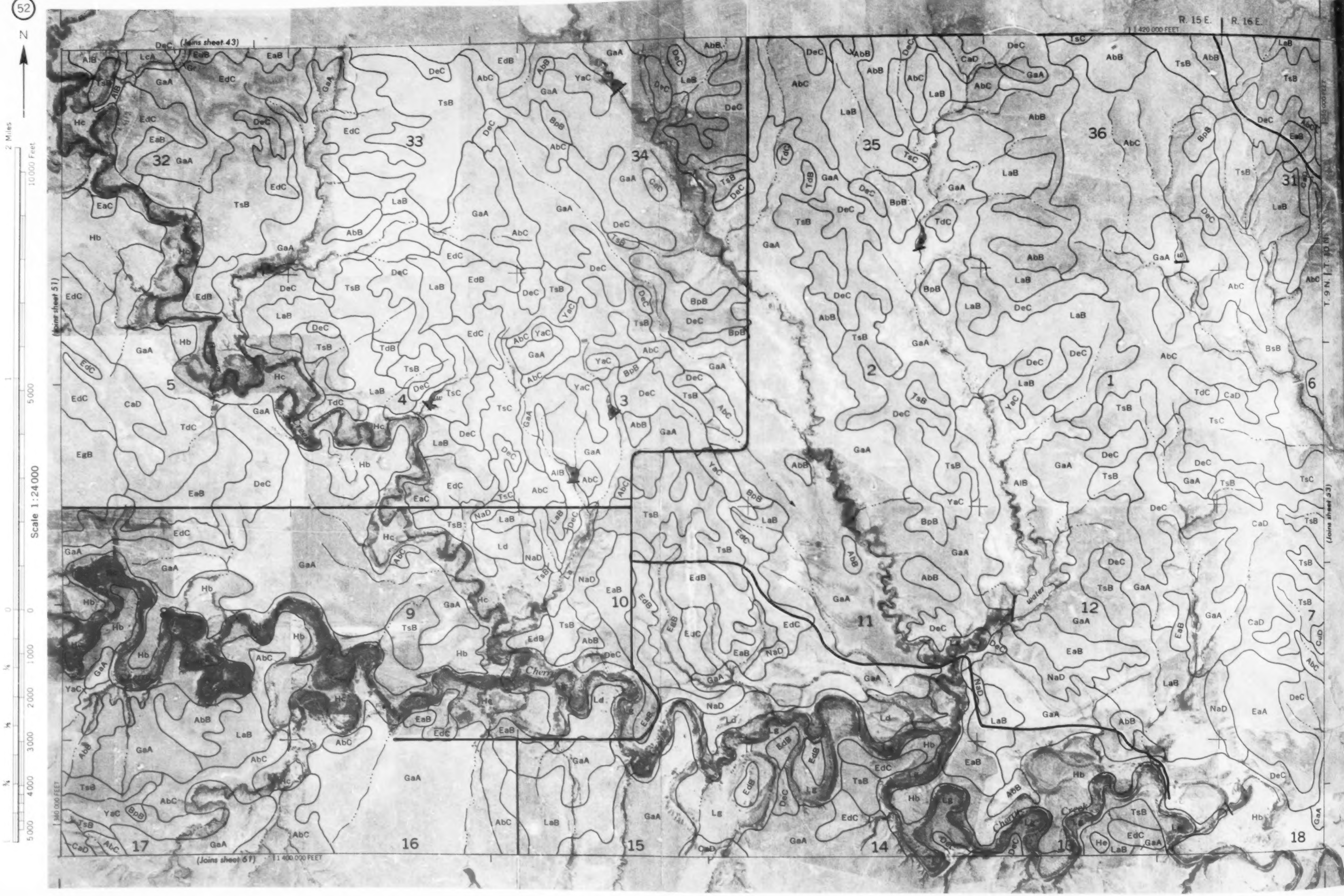

(Joins sheet 40)
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 48)
R. 12 E.
R. 13 E.
T. 9 N.
T. 10 N.
1 310 000 FEET
1 345 000 FEET
1 335 000 FEET
N
2 Miles
10 000 Feet
Scale 1:24 000
1
5000
0
1000
2000
3000
4000
5000

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 50

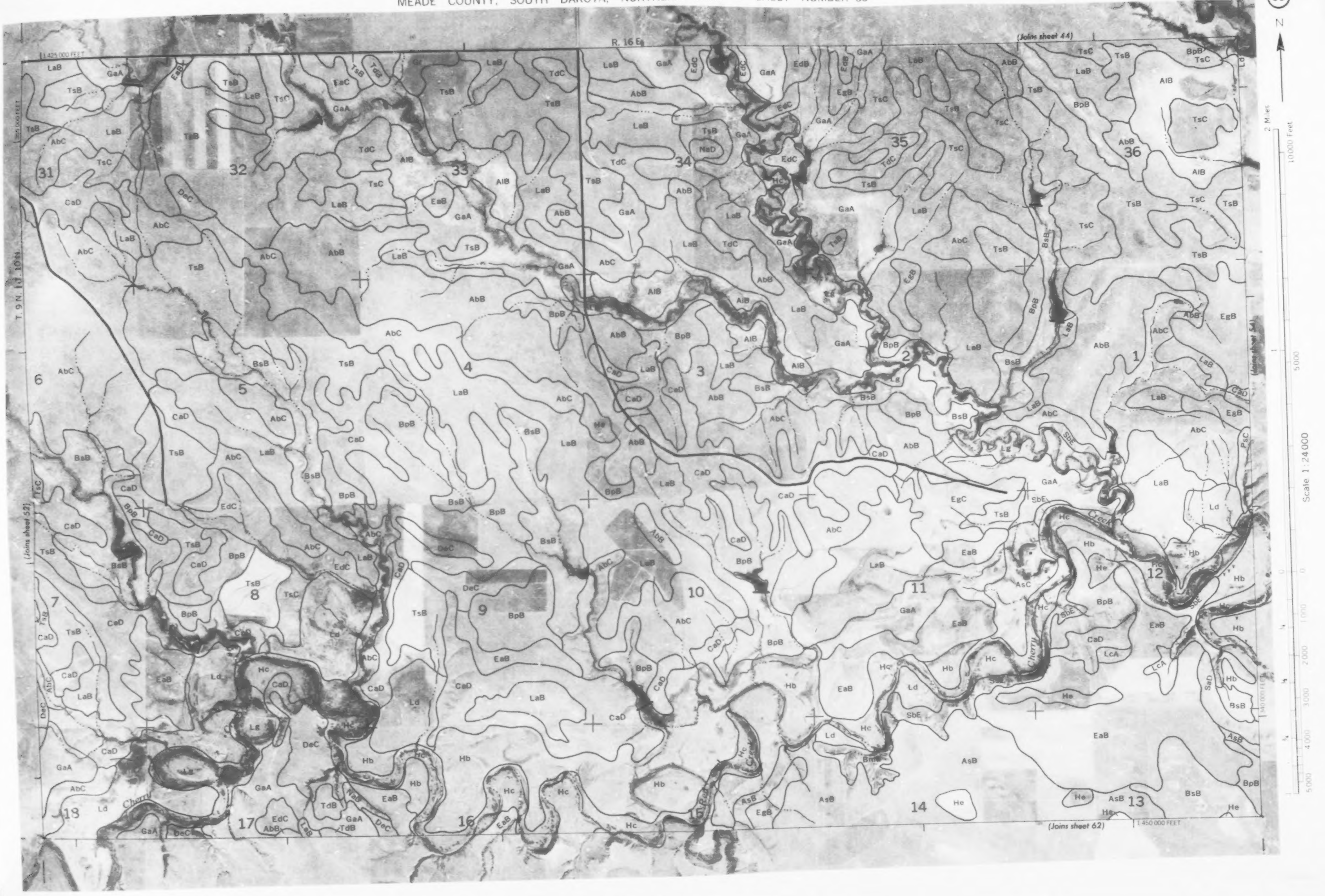

N
2 Miles
10 000 Feet
Scale 1:24 000
5000
1
0
1000
2000
3000
4000
5000
(Joins sheet 41)
(Joins sheet 49)
(Joins sheet 59)
R. 13 E.
R. 14 E.
T. 10 N.
T. 9 N.
365 000 FEET
345 000 FEET
1 340 000 FEET
31
32
33
34
35
36
1
2
3
4
6
7
8
9
10
11
12
13
14
15
16
17
18

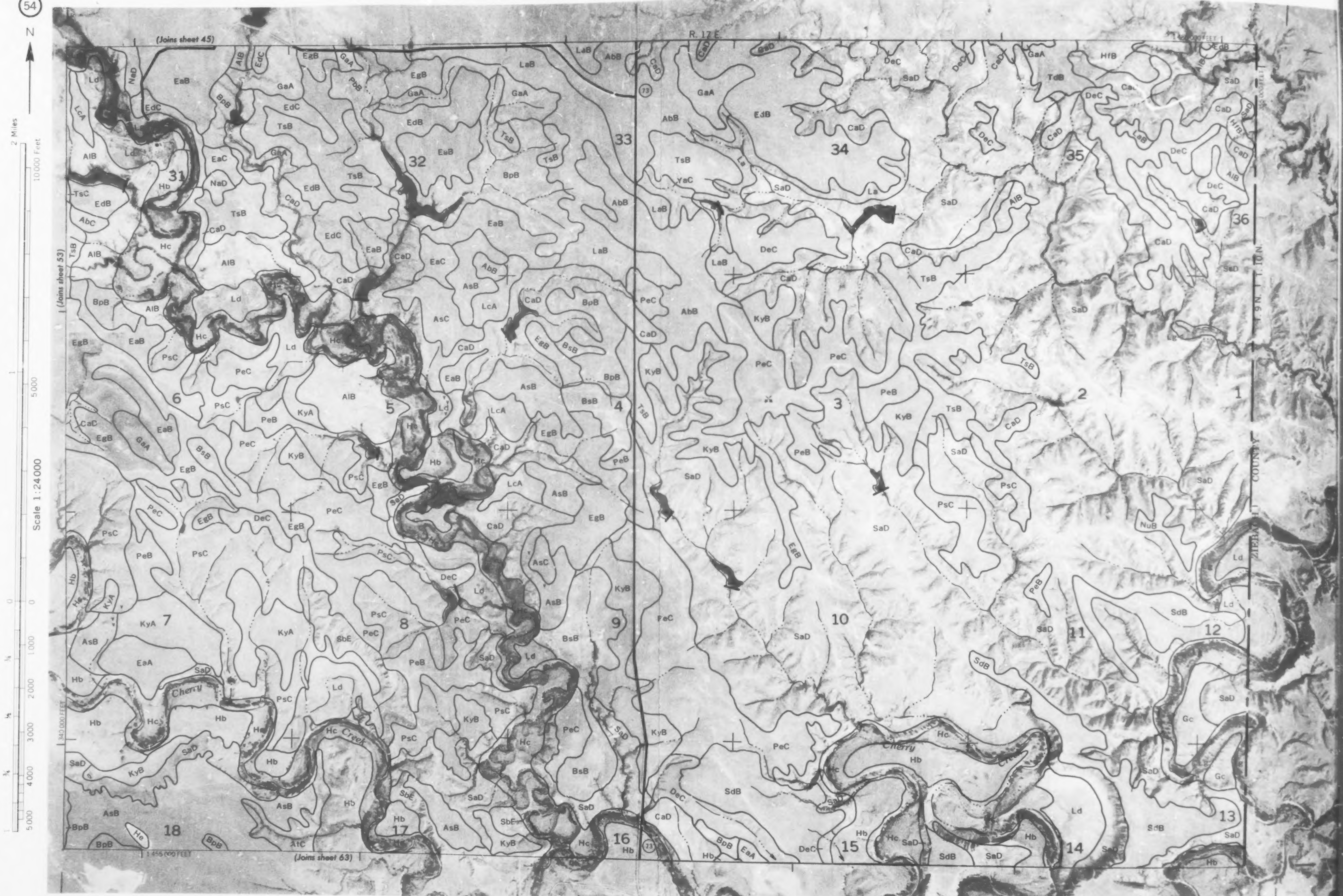
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 51


(51)
N
R. 14 E. | R. 15 E.
(Joins sheet 42)
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 60)
T. 10 N.
T. 9 N.
1 970 000 FEET
1 395 000 FEET
Sulphur
Creek
Scale 1:24 000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
1
2
3
4
6
7
8
9
10
11
12
13
14
15
16
17
18
31
32
33
34
35
36

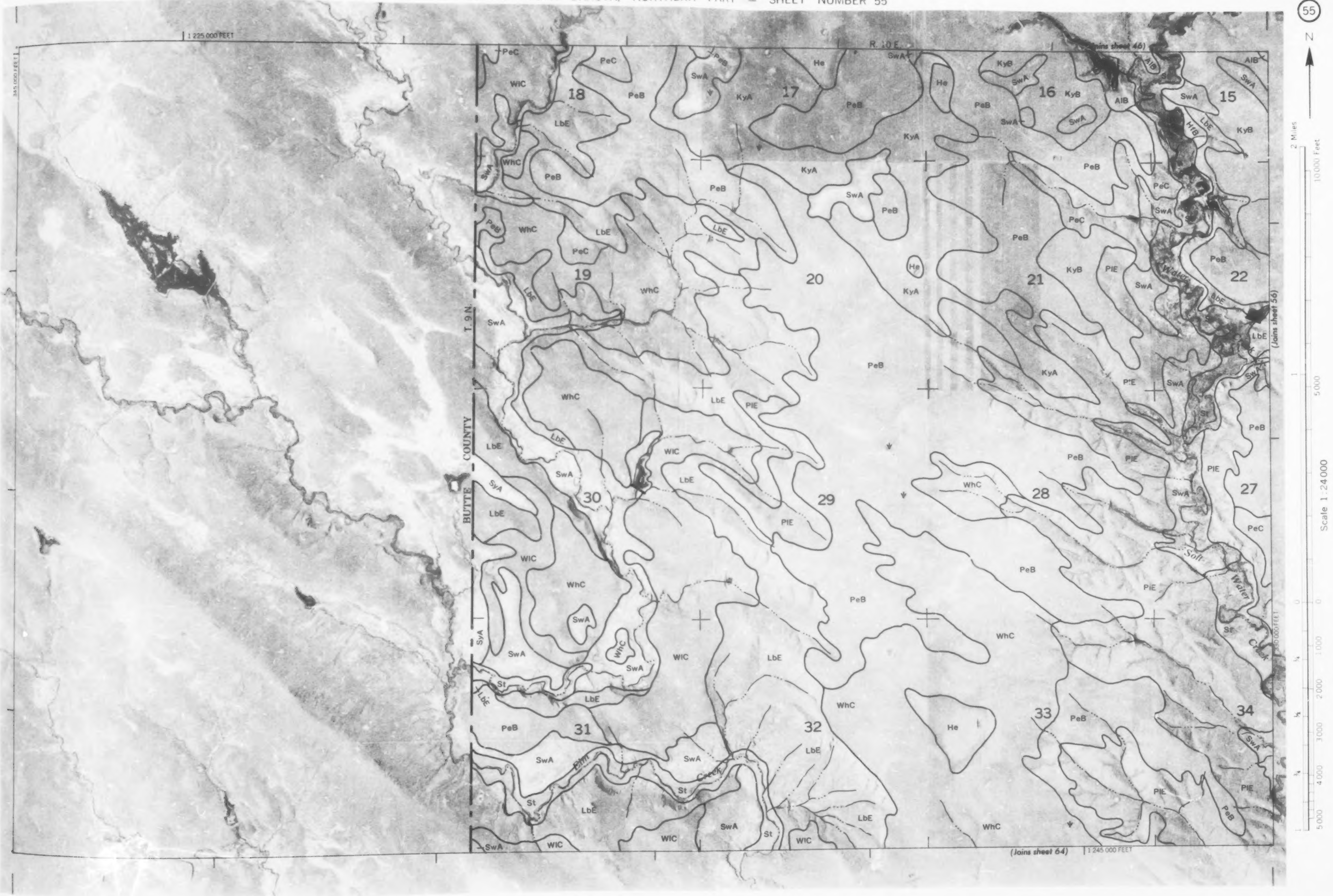

N
2 Miles
10 000 Feet
Scale 1:24 000
(Joins sheet 43)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 61)
R. 15 E.
R. 16 E.
T. 9 N.
T. 10 N.
1 420 000 FEET
1 400 000 FEET
340 000 FEET
32
33
34
35
36
31
5
4
3
2
1
6
9
10
11
12
7
17
16
15
14
13
18
Cherry Creek
water

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 53

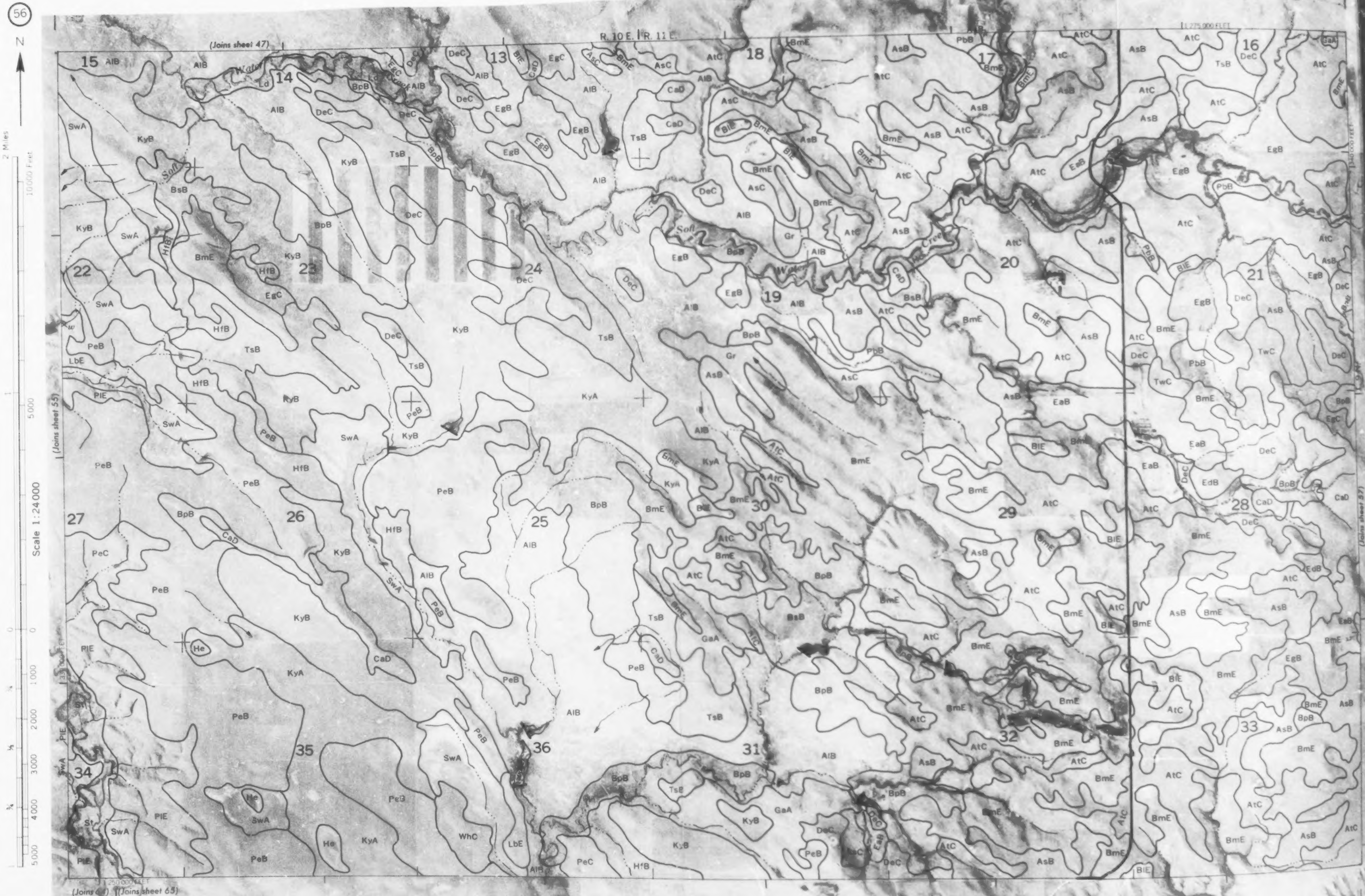

N
R. 16 E.
T. 9 N. | T. 10 N.
(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 62)
1 425 000 FEET
1 450 000 FEET
395 000 FEET
340 000 FEET
31
32
33
34
35
36
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Cherry Creek
Red Creek
LaB
GaA
TsB
TsC
AbB
AbC
AlB
BpB
BsB
CaD
DeC
EaB
EdC
EgB
EgC
Hb
Hc
He
Ld
Lg
LcA
AsB
AsC
SbE
SaD
NaD
TdB
TdC
PsC
Bmb
2 Miles
10000 Feet
5000
1
0
Scale 1:24000
1000
2000
3000
4000
5000


N
(Joins sheet 45)
(Joins sheet 53)
(Joins sheet 63)
R. 17 E.
T. 10 N.
ZIEBACH COUNTY
Cherry Creek
Scale 1:24 000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
340 000 FEET
1 455 000 FEET
73
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
31
32
33
34
35
36

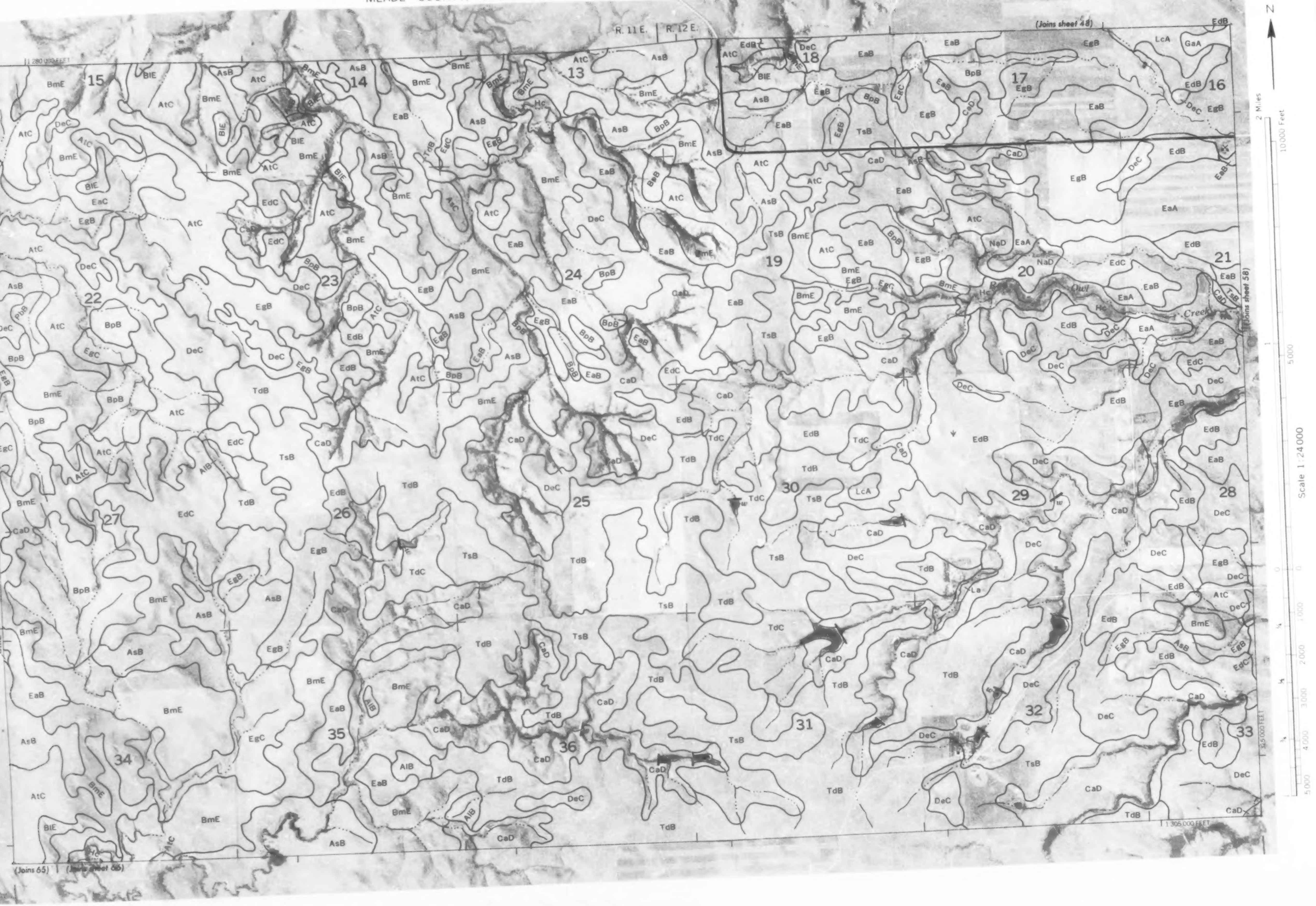
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 55

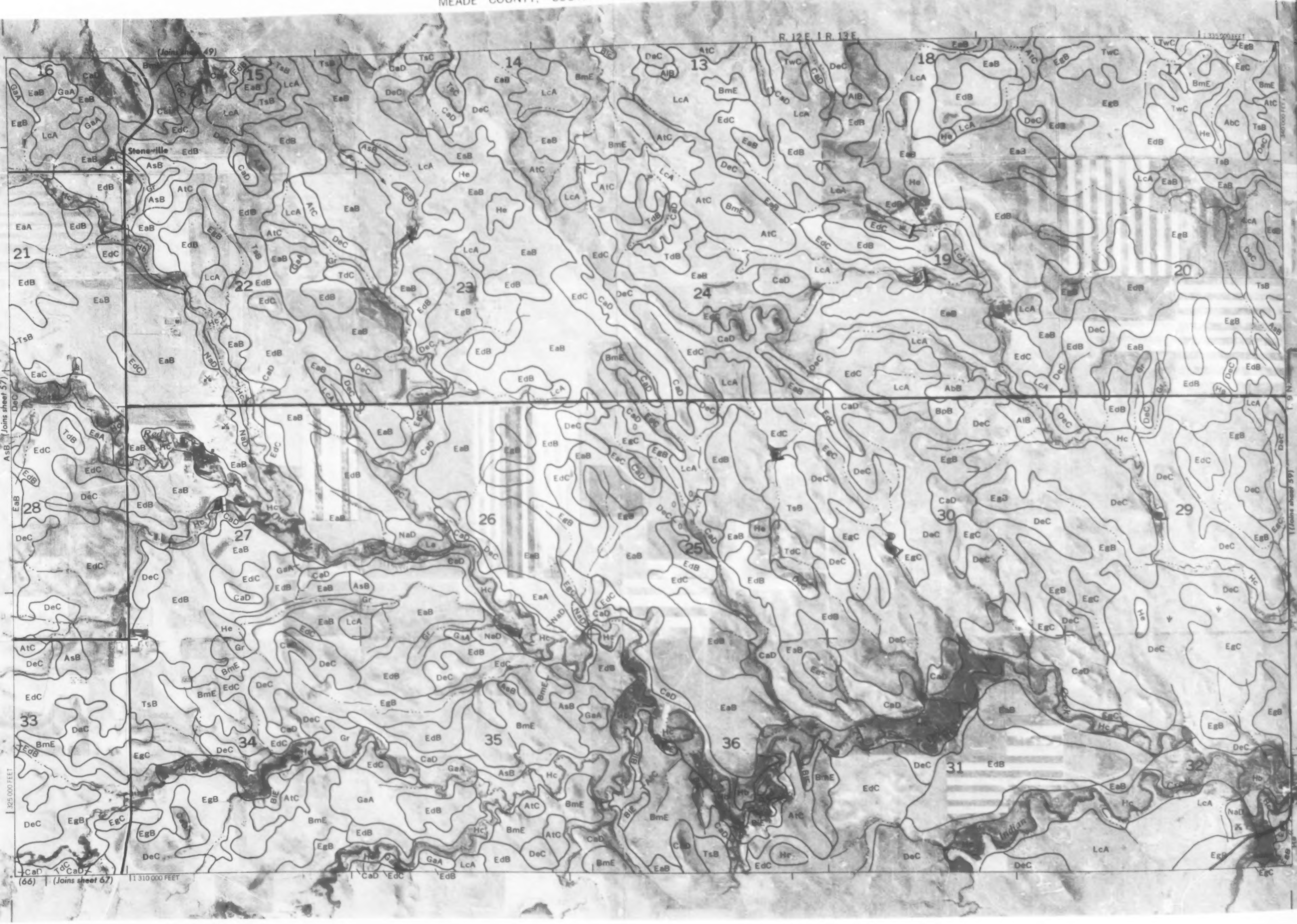

1 225 000 FEET
345 000 FEET
R. 10 E.
(Joins sheet 46)
(Joins sheet 56)
(Joins sheet 64)
1 245 000 FEET
320 000 FEET
T. 9 N.
BUTTE COUNTY
N
Scale 1:24000
2 Miles
1
0
1/2
10000 Feet
5000
0
1000
2000
3000
4000
5000
15
16
17
18
19
20
21
22
27
28
29
30
31
32
33
34
PeC
WlC
PeB
SwA
KyA
He
KyB
AlB
HtB
LbE
WhC
PeC
PlE
SyA
St
Water
Soft Water Creek
Elm Creek

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 56

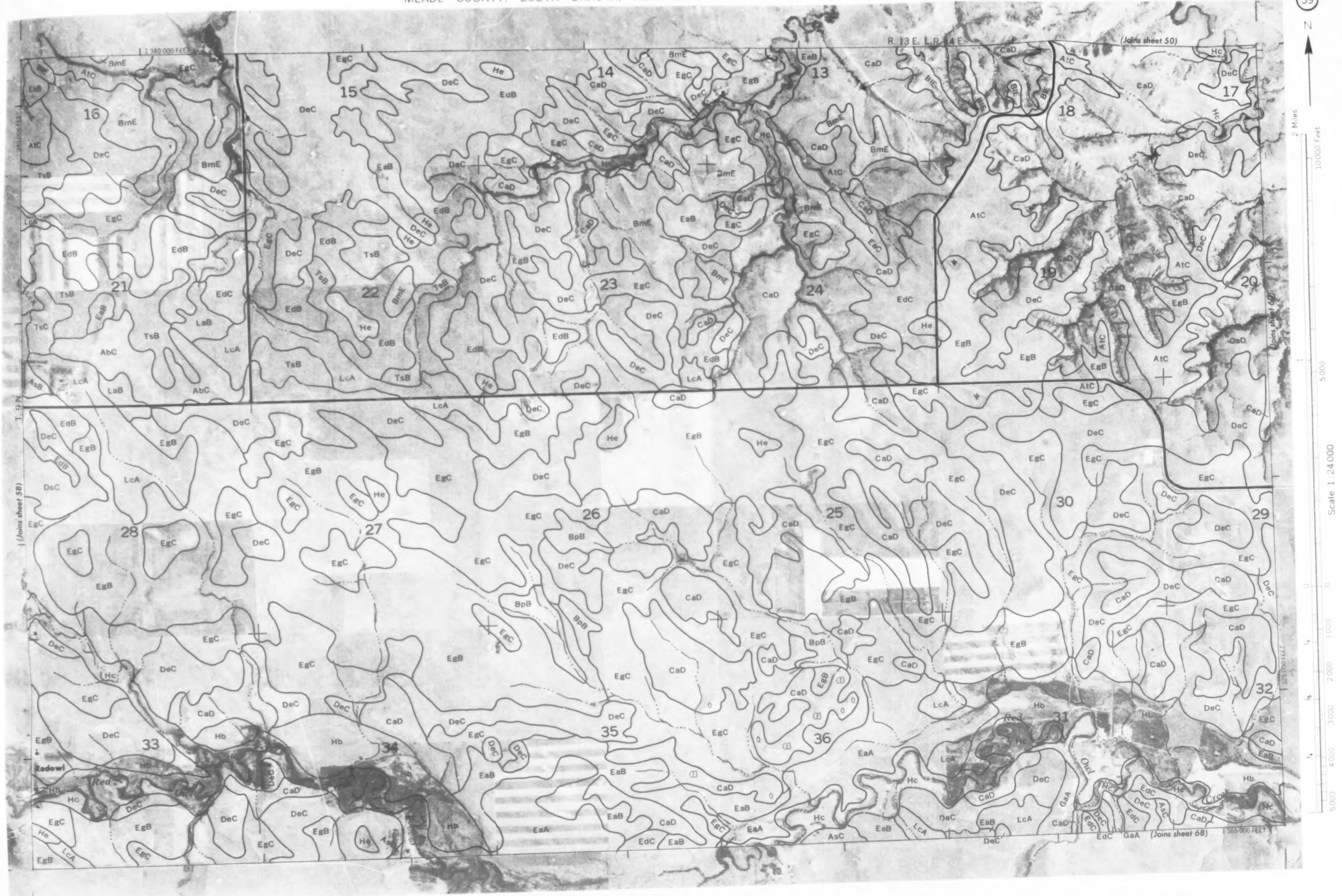

56
N
2 Miles
10 000 Feet
5 000
0
1000
2000
3000
4000
5000
1
½
0
¼
½
¾
1
Scale 1:24 000
(Joins sheet 47)
R. 10 E. | R. 11 E.
1 275 000 FEET
(Joins sheet 55)
(Joins sheet 57)
250 000 FEET
(Joins 64)
(Joins sheet 63)
15
14
13
18
17
16
22
23
24
19
20
21
27
26
25
30
29
28
34
35
36
31
32
33
Soft Water Creek
AlB
AsB
AsC
AtC
BlE
BmE
BpB
BsB
CaD
DeC
EaB
EdB
EgB
EgC
GaA
Gr
He
HfB
KyA
KyB
LbE
Ld
PbB
PeB
PeC
PlE
St
SwA
TsB
TwC
WhC
w

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 57

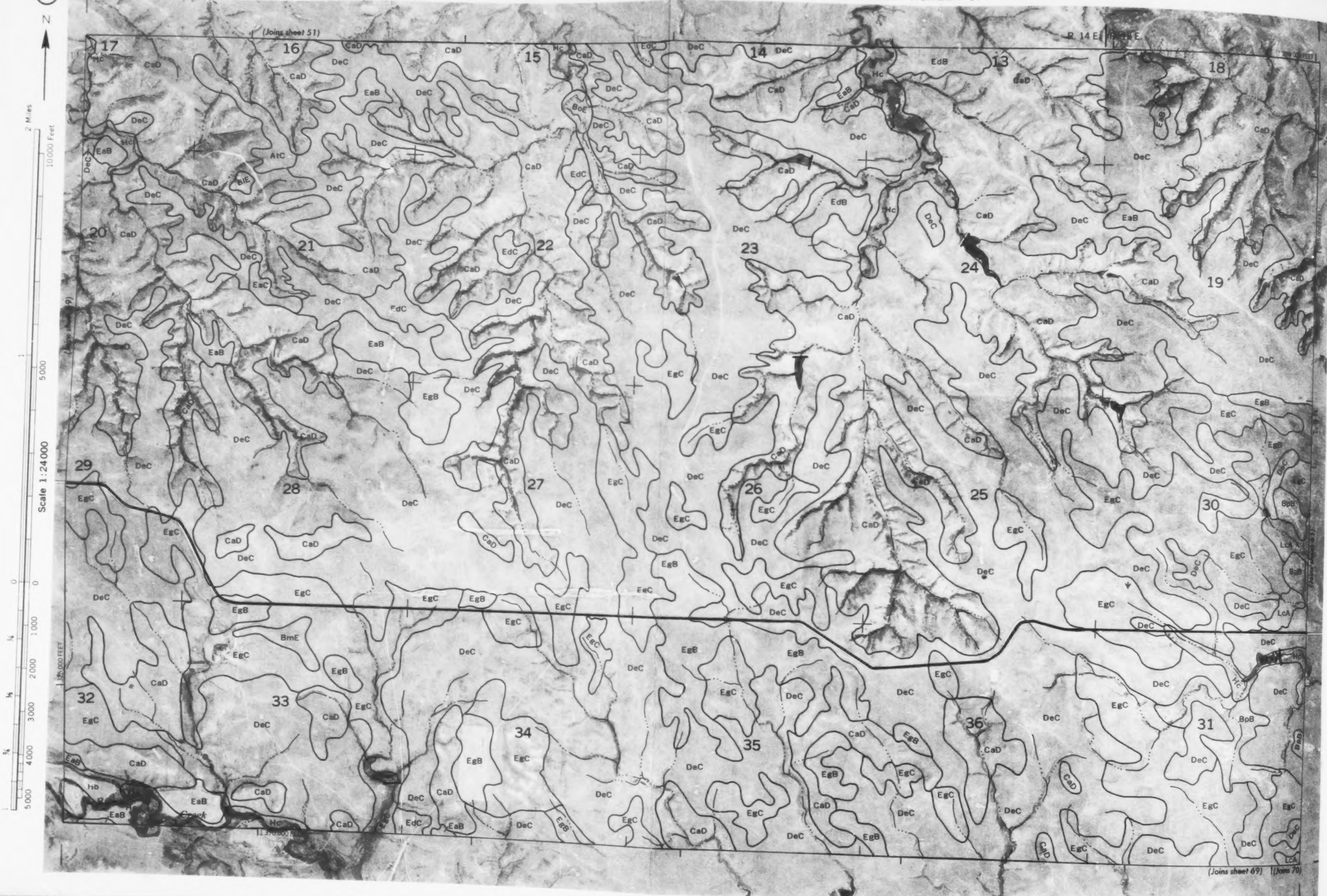

R. 11 E.
R. 12 E.
(Joins sheet 48)
1 280 000 FEET
(Joins sheet 58)
(Joins 65)
(Joins sheet 66)
1 305 000 FEET
125 000 FEET
Owl Creek
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
N
2 Miles
10 000 Feet
5000
Scale 1:24 000
0
1000
2000
3000
4000
5000


(Joins sheet 49)
R. 12 E. | R. 13 E.
1 335 000 FEET
Stoneville
16
15
14
13
18
17
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32
Indian
(Joins sheet 57)
(Joins sheet 59)
(66)
(Joins sheet 67)
1 310 000 FEET
325 000 FEET
340 000 FEET
T. 6 N.

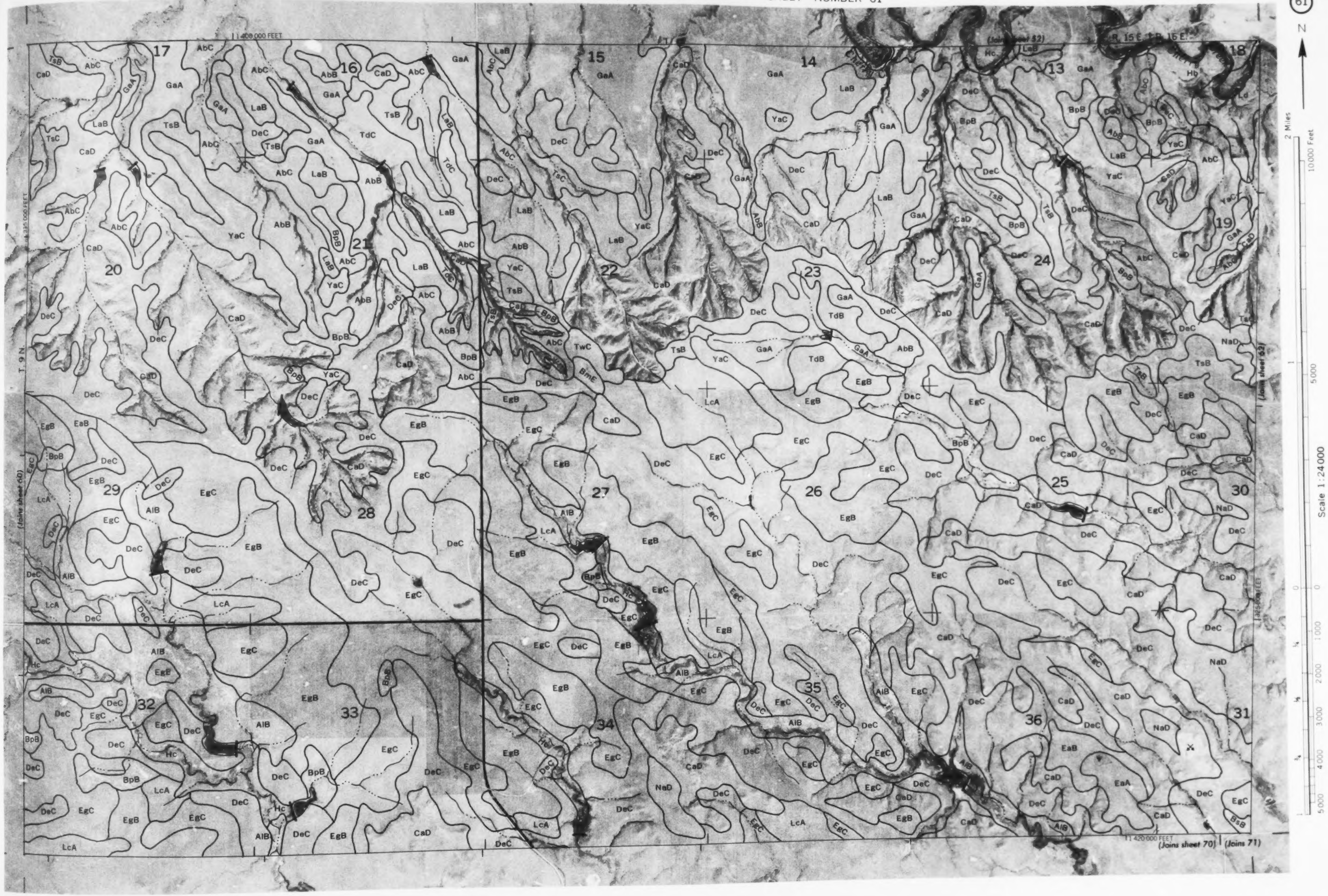
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 59


R. 13 E. | R. 14 E.
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 60)
(Joins sheet 68)
T. 9 N.
1 340 000 FEET
325 000 FEET
1 365 000 FEET
N
2 Miles
10 000 Feet
Scale 1:24 000
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
Radowl
Red Owl Creek
AbC
AsB
AsC
AtC
BlE
BmE
BpB
CaD
DeC
EaA
EaB
EdB
EdC
EgB
EgC
GaA
Hb
Hc
He
LaB
LcA
TsB
TsC

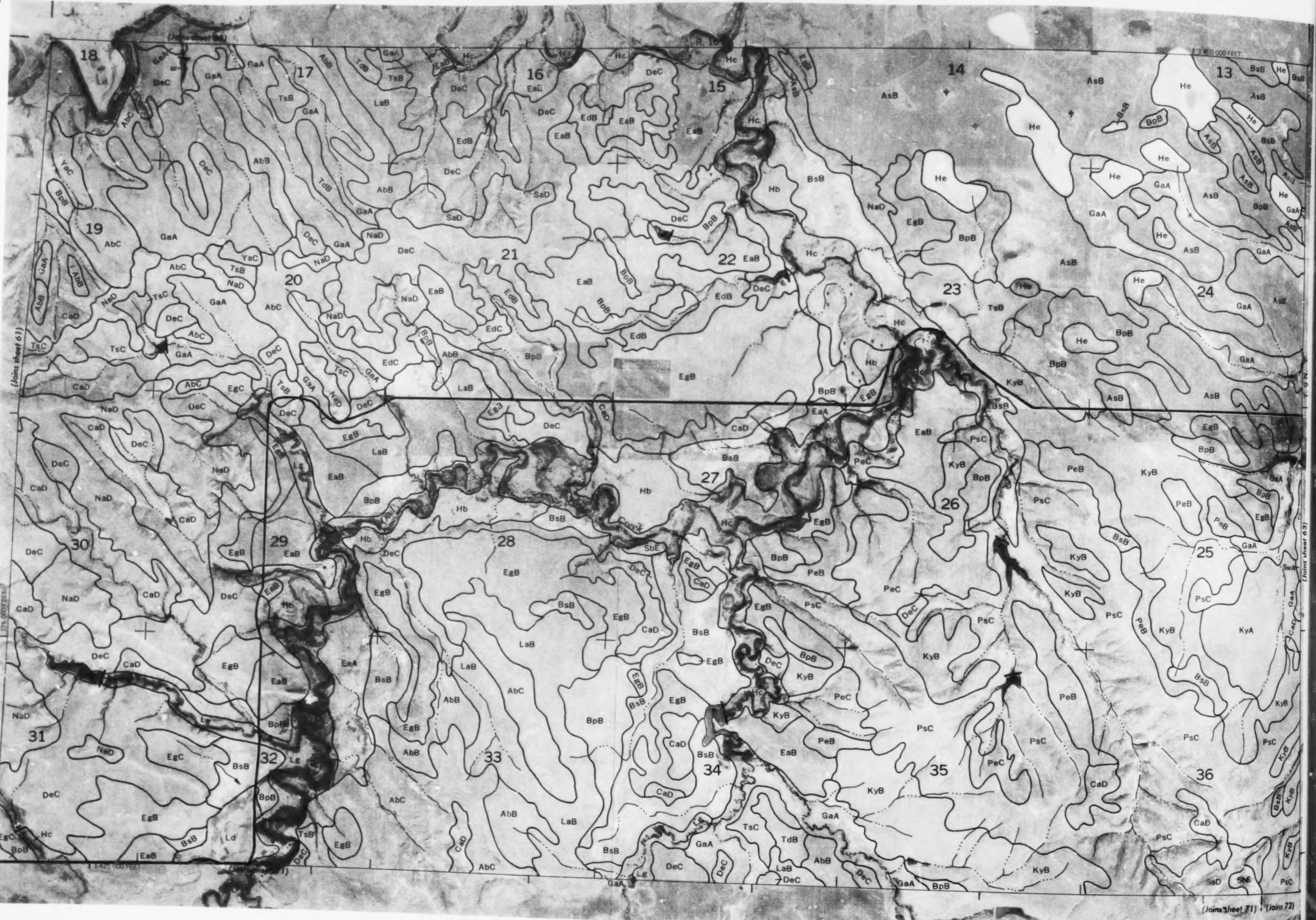
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 60


N
2 Miles
10 000 Feet
5000
Scale 1:24000
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 51)
(Joins sheet 69)
(Joins 70)
R. 14 E.
R. 15 E.
Creek
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
AtC
BmE
BoE
BlE
BpB
BbB
CaD
DeC
EaB
EaC
EdB
EdC
EgB
EgC
Hb
Hc
LcA

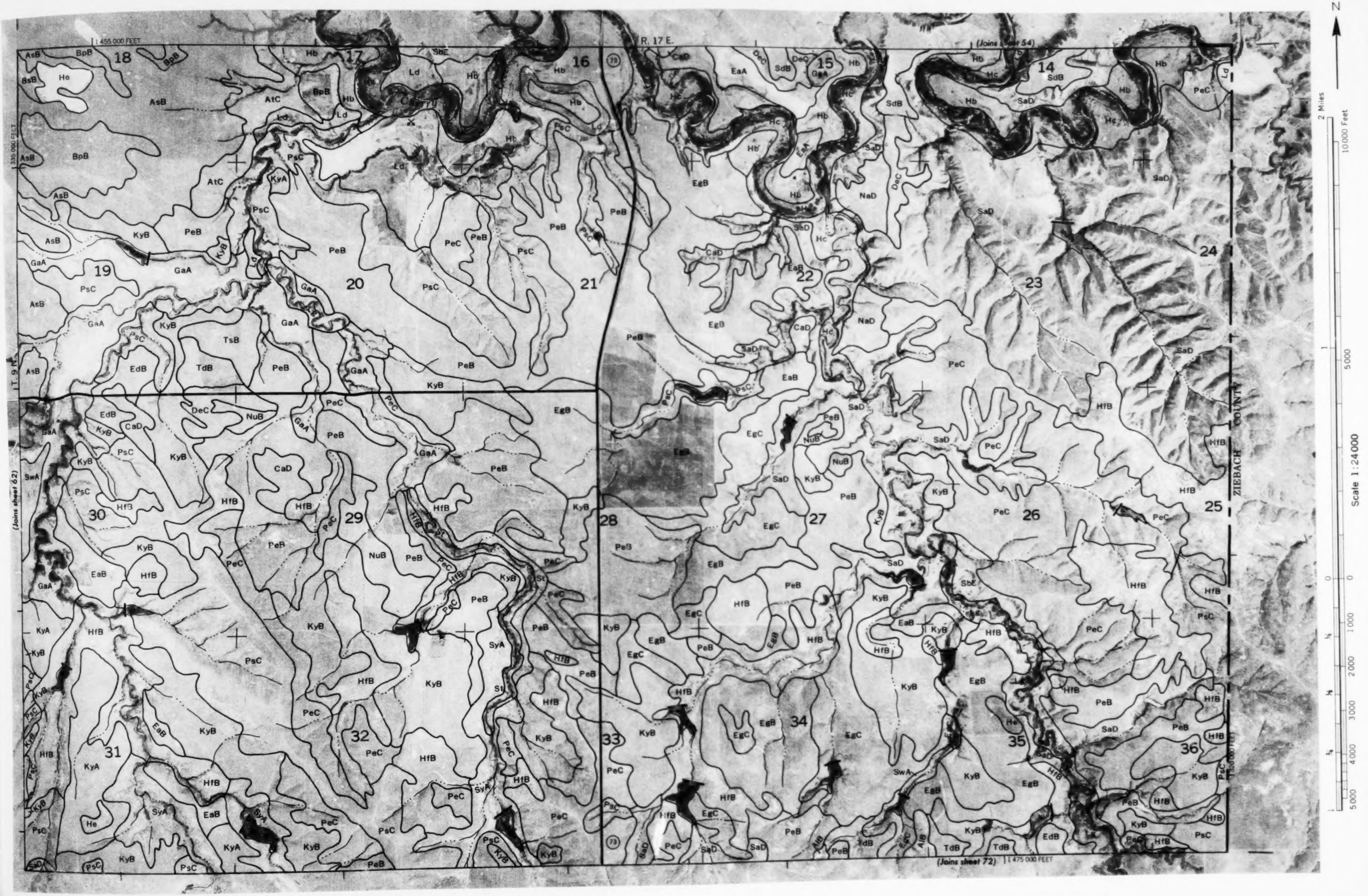
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 61


N
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
1
0
Scale 1:24000
1 400 000 FEET
1 420 000 FEET
T. 9 N.
R. 15 E. | R. 16 E.
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 70)
(Joins 71)
Cherry
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
AbB
AbC
AlB
BmE
BpB
BsB
CaD
DeC
EaA
EaB
EgB
EgC
GaA
Hb
Hc
LaB
LcA
Ld
NaD
TdB
TdC
TsB
TsC
TwC
YaC

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 62

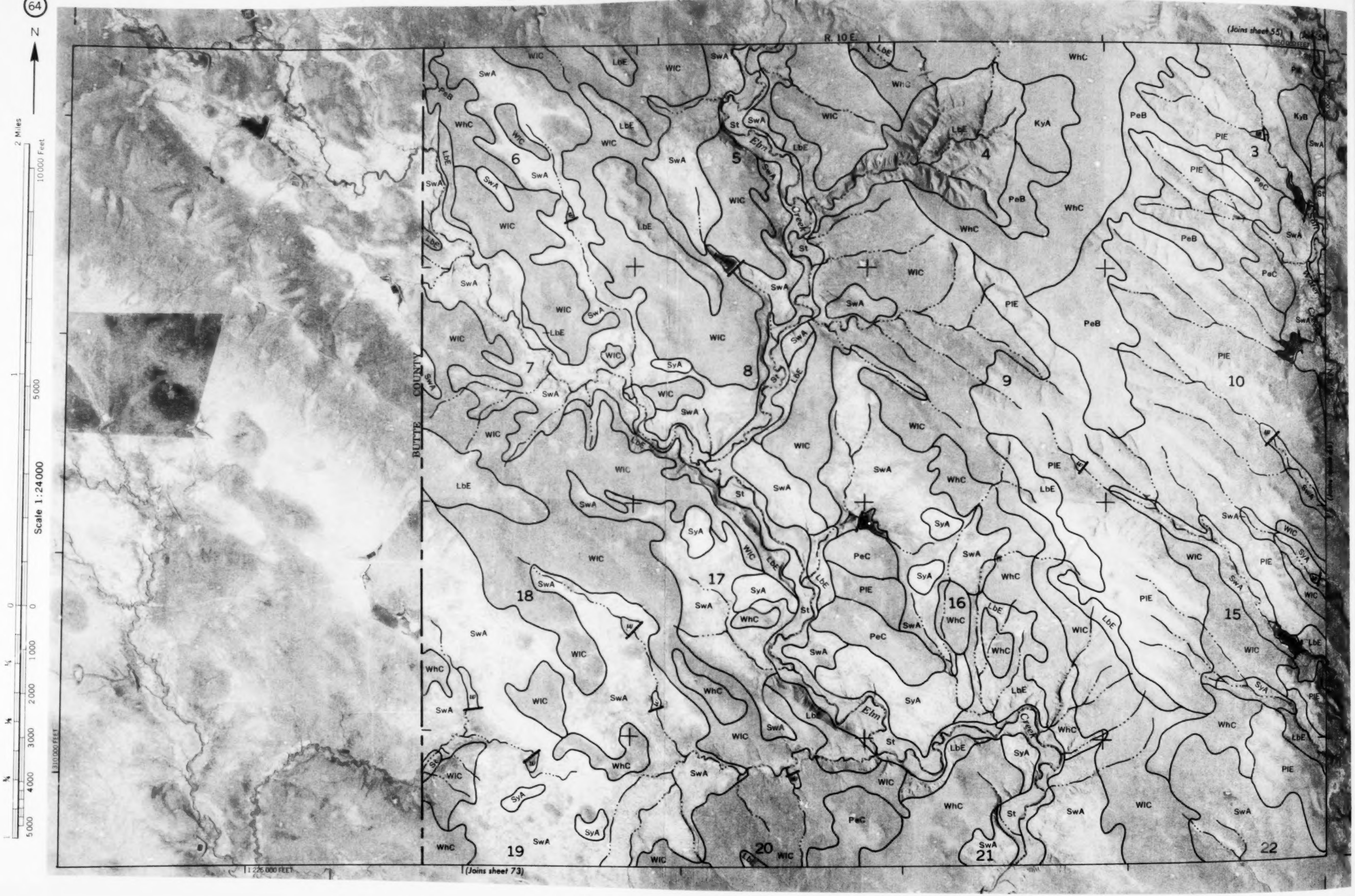

(Joins sheet 60)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 71)
(Joins 72)
R. 16 E.
T. 9 N.
1 850 000 FEET
1 425 000 FEET
325 000 FEET
Oak Creek
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
AbB
AbC
AsB
BpB
BsB
CaD
DeC
EaB
EdB
EdC
EgB
EgC
GaA
Hb
Hc
He
KyA
KyB
LaB
Lg
Ld
NaD
PeB
PeC
PsC
SaD
SbE
SwA
TdB
TsB
TsC
YaC

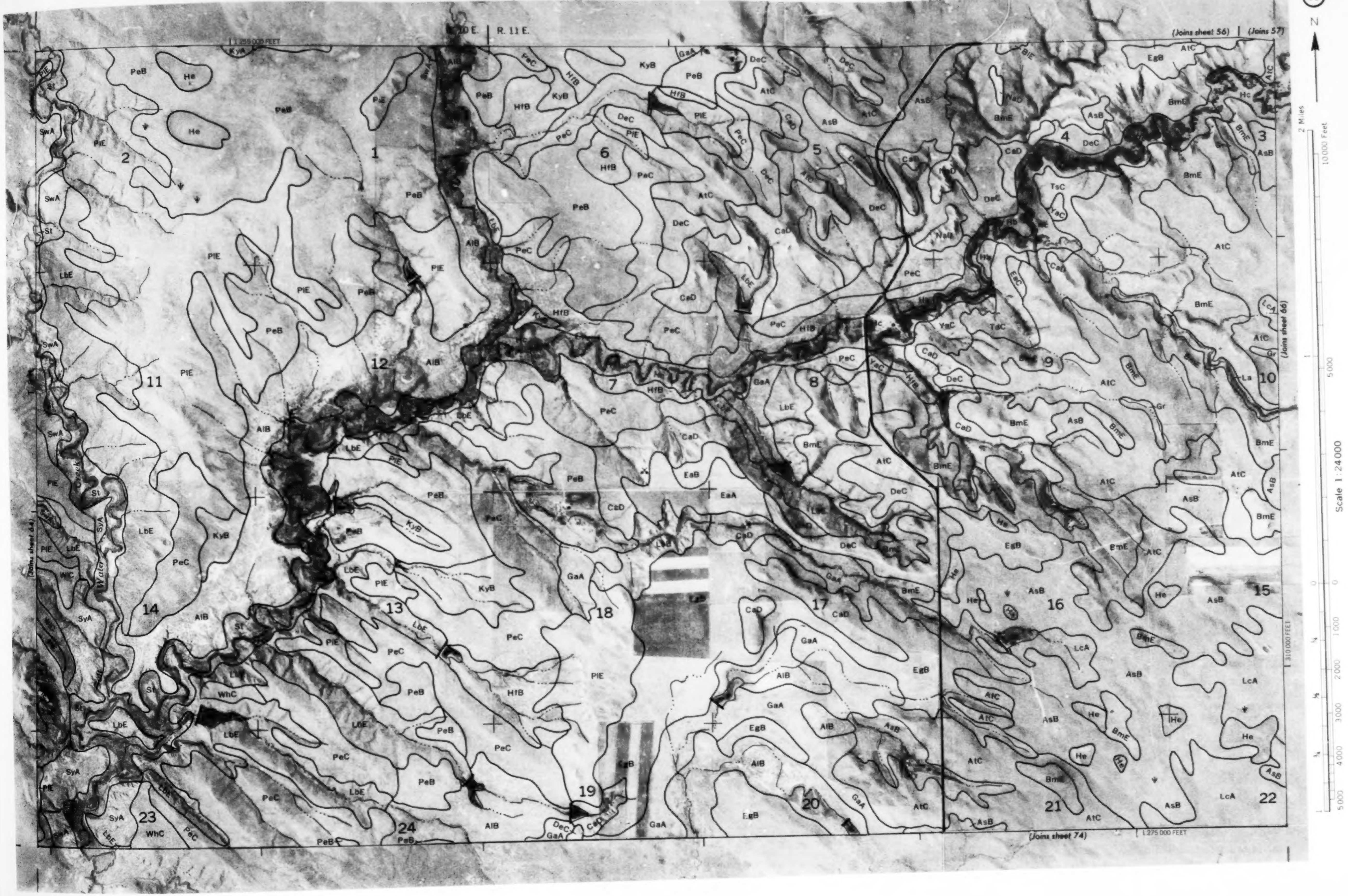
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 63



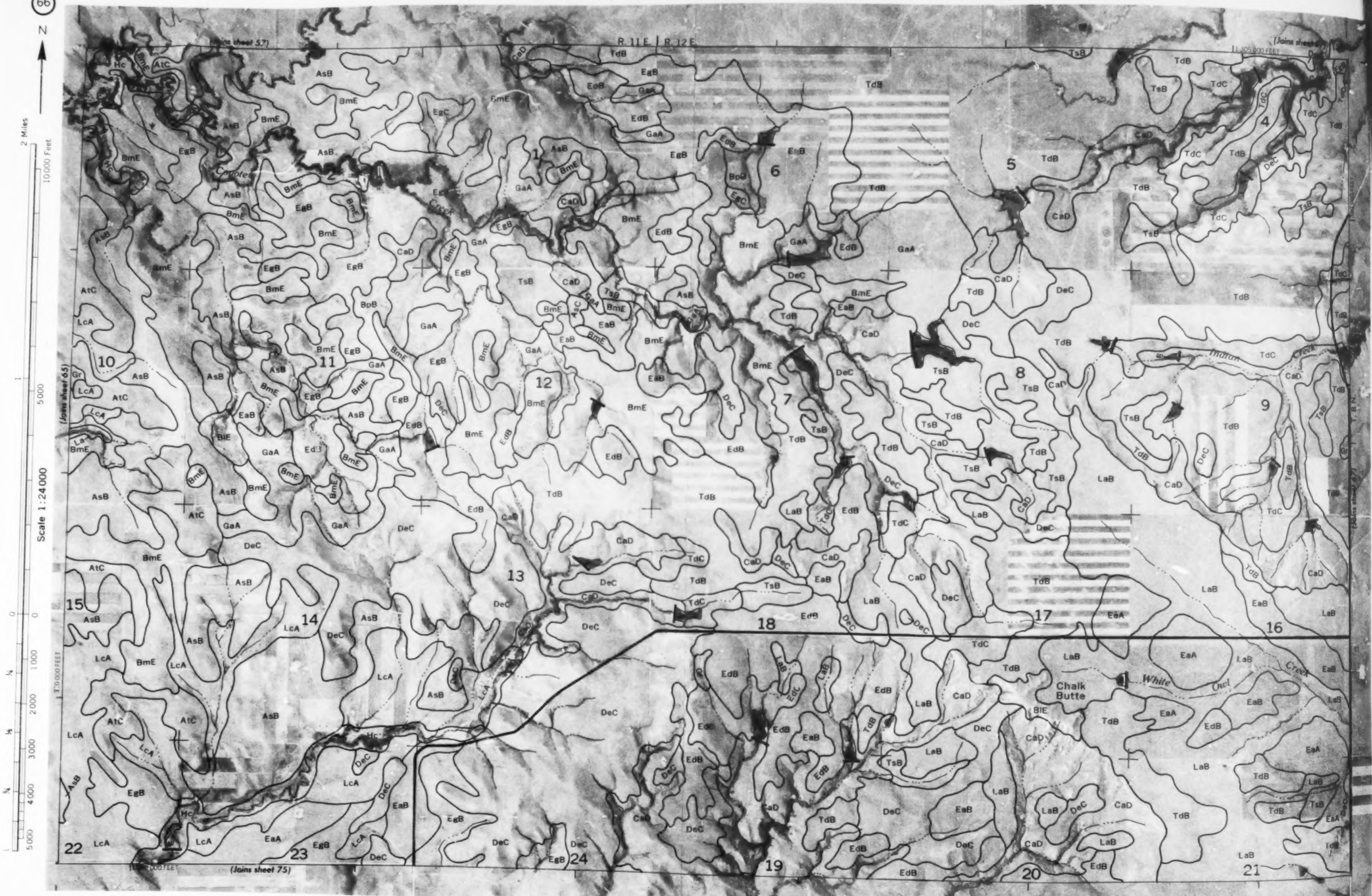
N
Scale 1:24 000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 72)
R. 17 E.
T. 9 N.
ZIEBACH COUNTY
1 455 000 FEET
1 475 000 FEET
335 000 FEET
18
17
16
15
14
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36

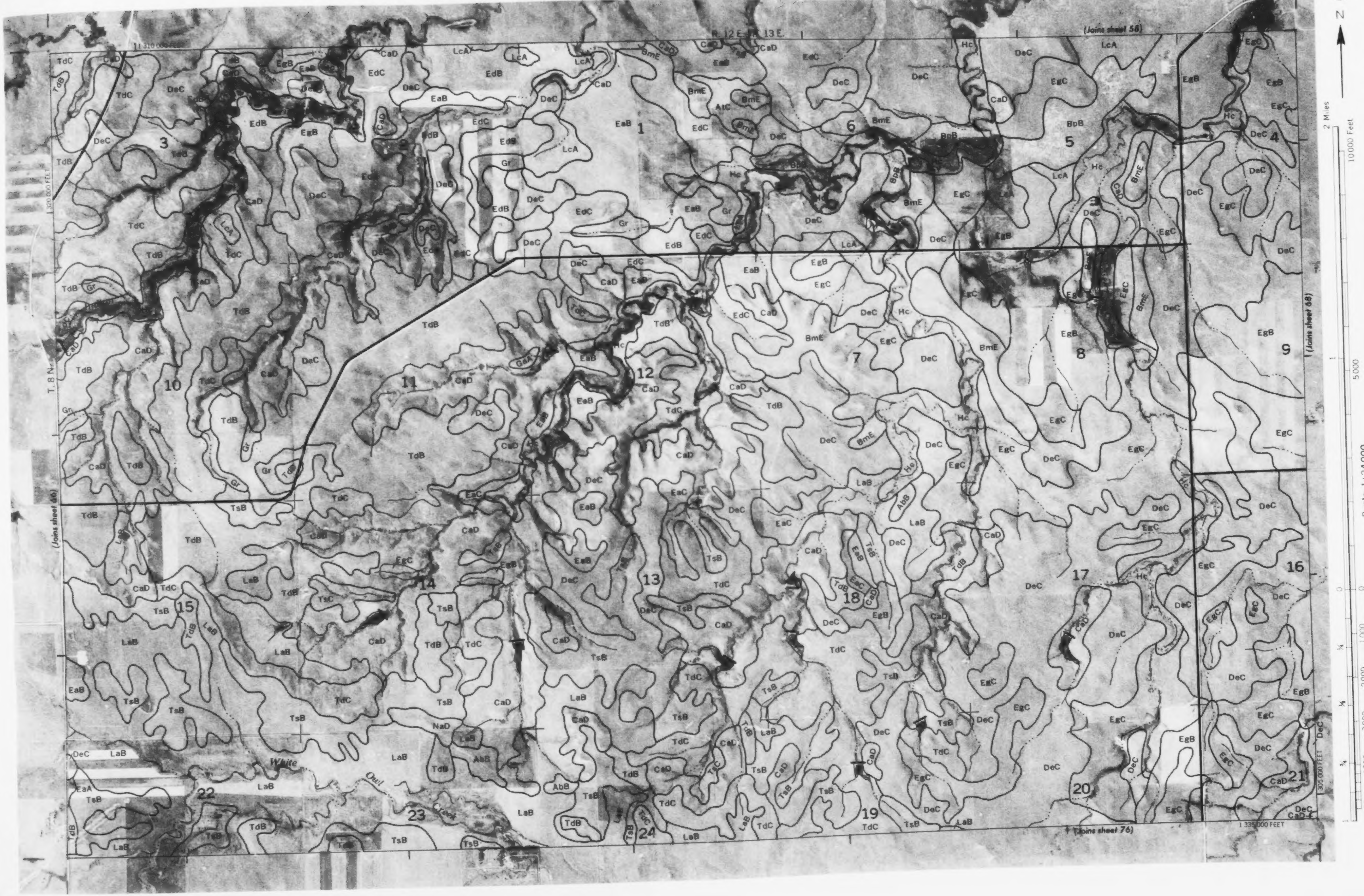
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 64


N
2 Miles
10 000 Feet
5000
1
0
Scale 1:24 000
1000
2000
3000
4000
5000
(Joins sheet 55)
R. 10 E.
BUTTE COUNTY
Elm Creek
(Joins sheet 73)
1 225 000 FEET
310 000 FEET
3
4
5
6
7
8
9
10
15
16
17
18
19
20
21
22
SwA
WlC
WhC
LbE
PeB
PeC
PlE
SyA
KyA
KyB
St

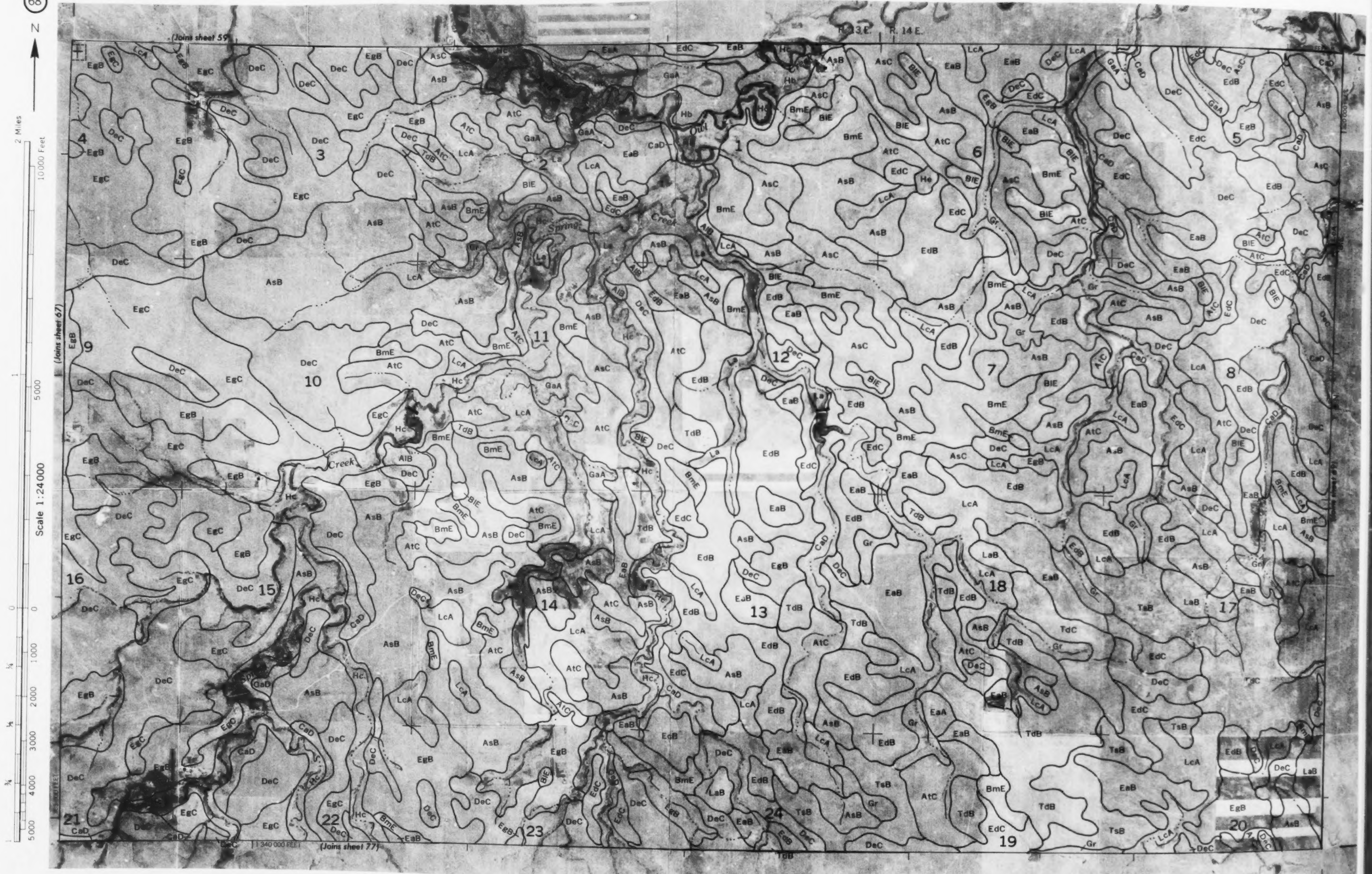

R. 10 E.
R. 11 E.
1 255 000 FEET
(Joins sheet 56)
(Joins 57)
(Joins sheet 66)
(Joins sheet 74)
(Joins sheet 64)
1 275 000 FEET
310 000 FEET
Water Creek
N
2 Miles
10000 Feet
1
5000
0
Scale 1:24000

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 66

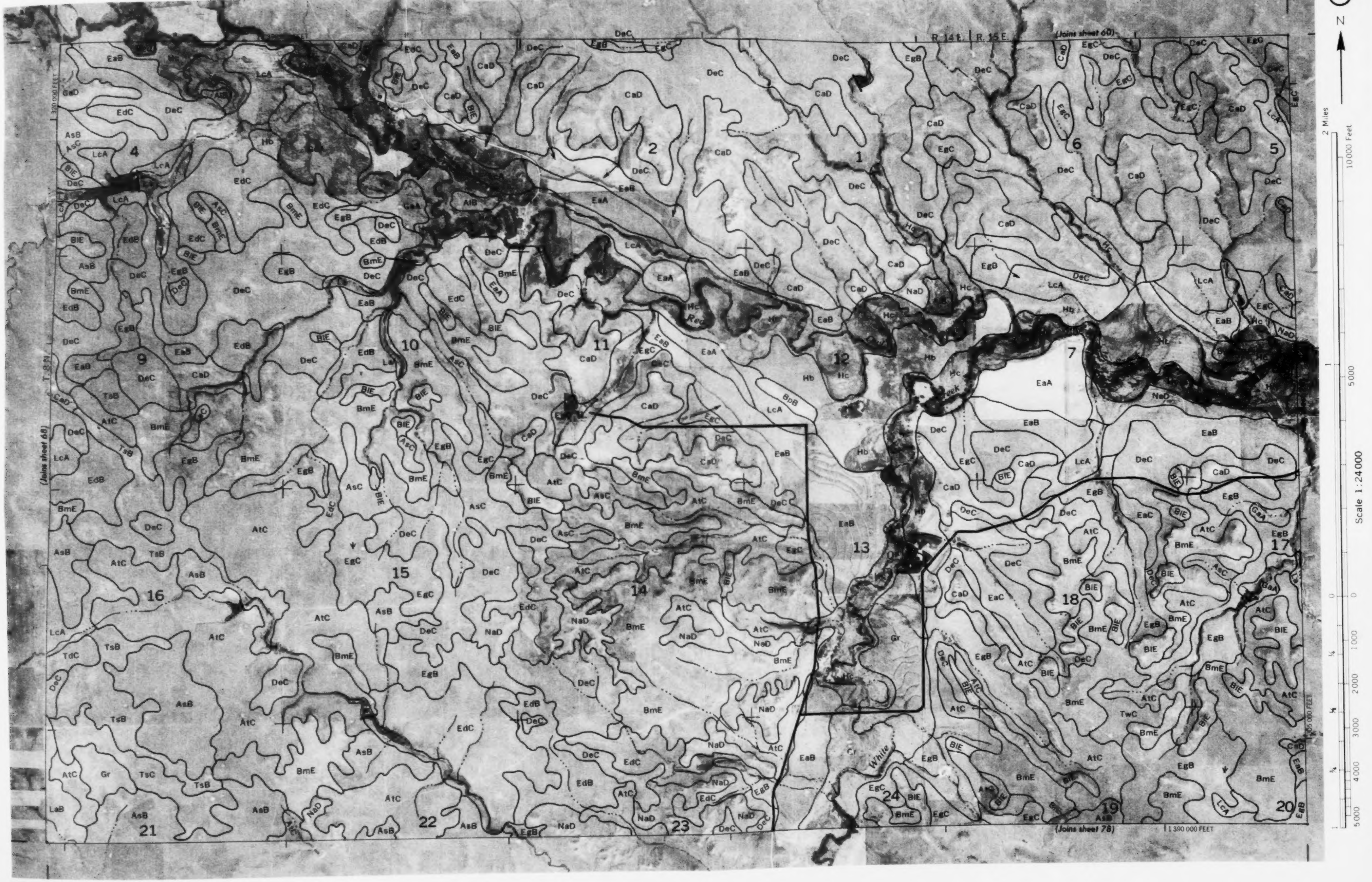

N
2 Miles
10000 Feet
5000
1
0
Scale 1:24000
¼
½
¾
1000
2000
3000
4000
5000
(Joins sheet 57)
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 75)
R.11E. | R.12E.
Coyote Creek
Indian Creek
White Owl Creek
Chalk Butte
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
AsB
AtC
BmE
BpB
BlE
CaD
DeC
EaA
EaB
EdB
EgB
EgC
GaA
Gr
Hc
LaB
LcA
TdB
TdC
TsB


N
(Joins sheet 58)
(Joins sheet 66)
(Joins sheet 76)
R. 12 E. R. 13 E.
T. 8 N.
1 310 000 FEET
320 000 FEET
305 000 FEET
1 335 000 FEET
White Owl Creek
2 Miles
10000 Feet
5000
1
0
1000
2000
Scale 1:24000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
TdC
CaD
TdB
DeC
EdB
EgB
EdC
EaB
LcA
BmE
AlC
BpB
Hc
Gr
EgC
DeB
TsB
LaB
EaC
TsC
GsA
AbB
NaD
EaA
TdC

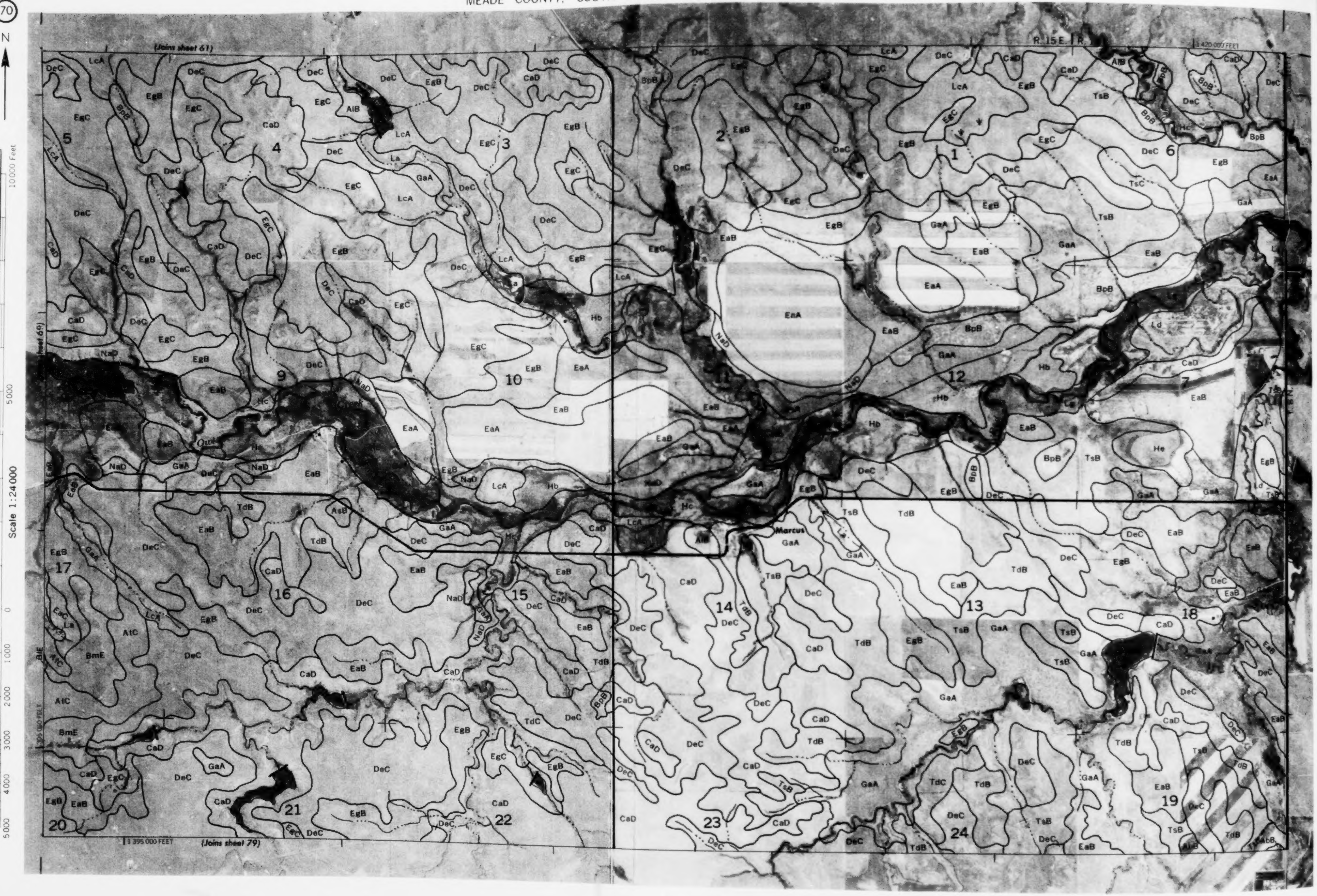
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 68


N
2 Miles
10000 Feet
5000
Scale 1:24000
1
0
½
1000
2000
3000
4000
5000
(Joins sheet 59)
(Joins sheet 67)
(Joins sheet 77)
1 340 000 FEET
R. 13 E.
R. 14 E.
Owl
Creek
Spring
Creek
Creek
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

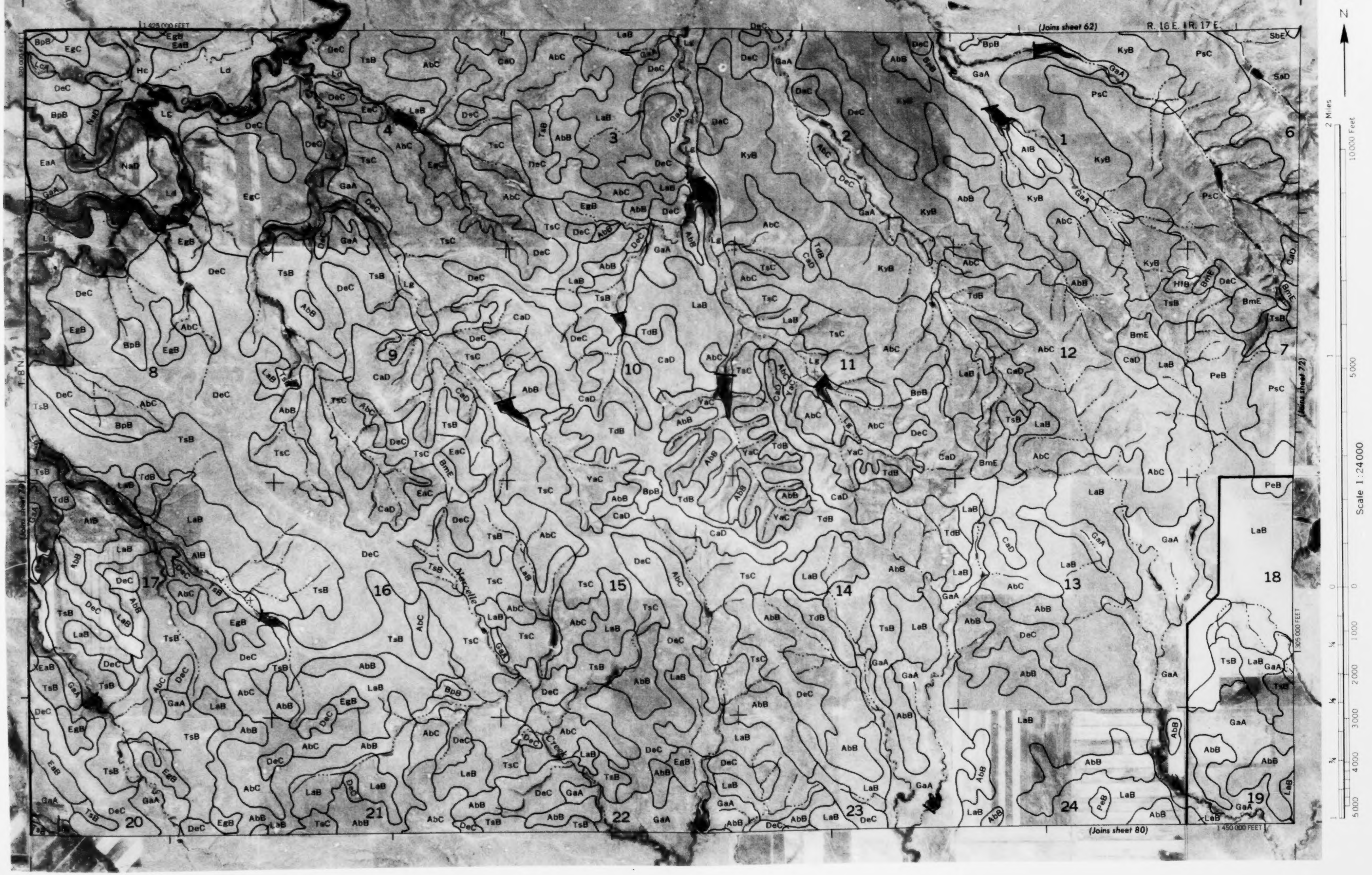
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 69


(Joins sheet 60)
R. 14 E.
R. 15 E.
(Joins sheet 68)
(Joins sheet 78)
T. 8 N.
320 000 FEET
1 390 000 FEET
N
2 Miles
10000 Feet
Scale 1:24000
Red
White
Creek
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

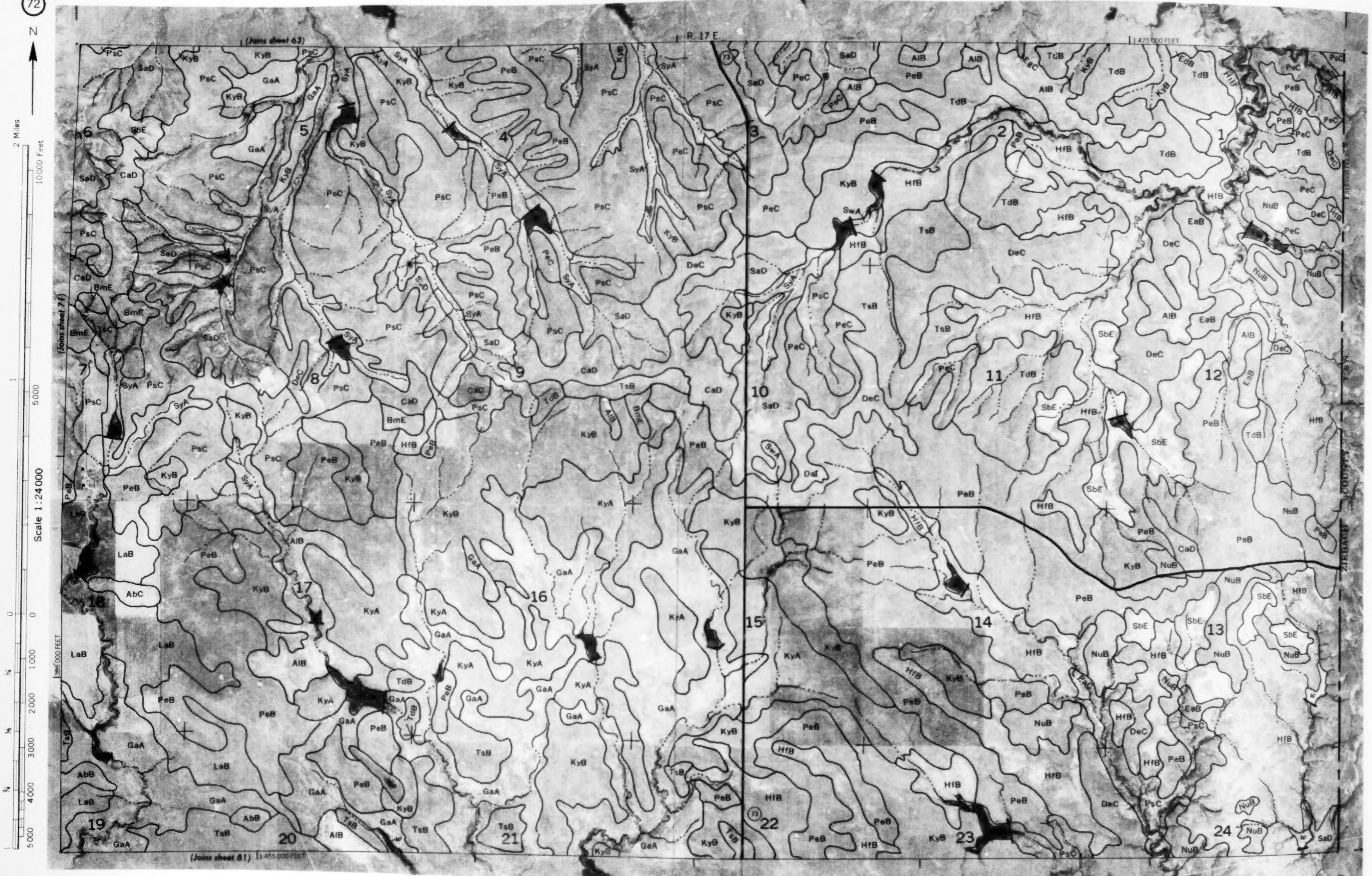
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 70

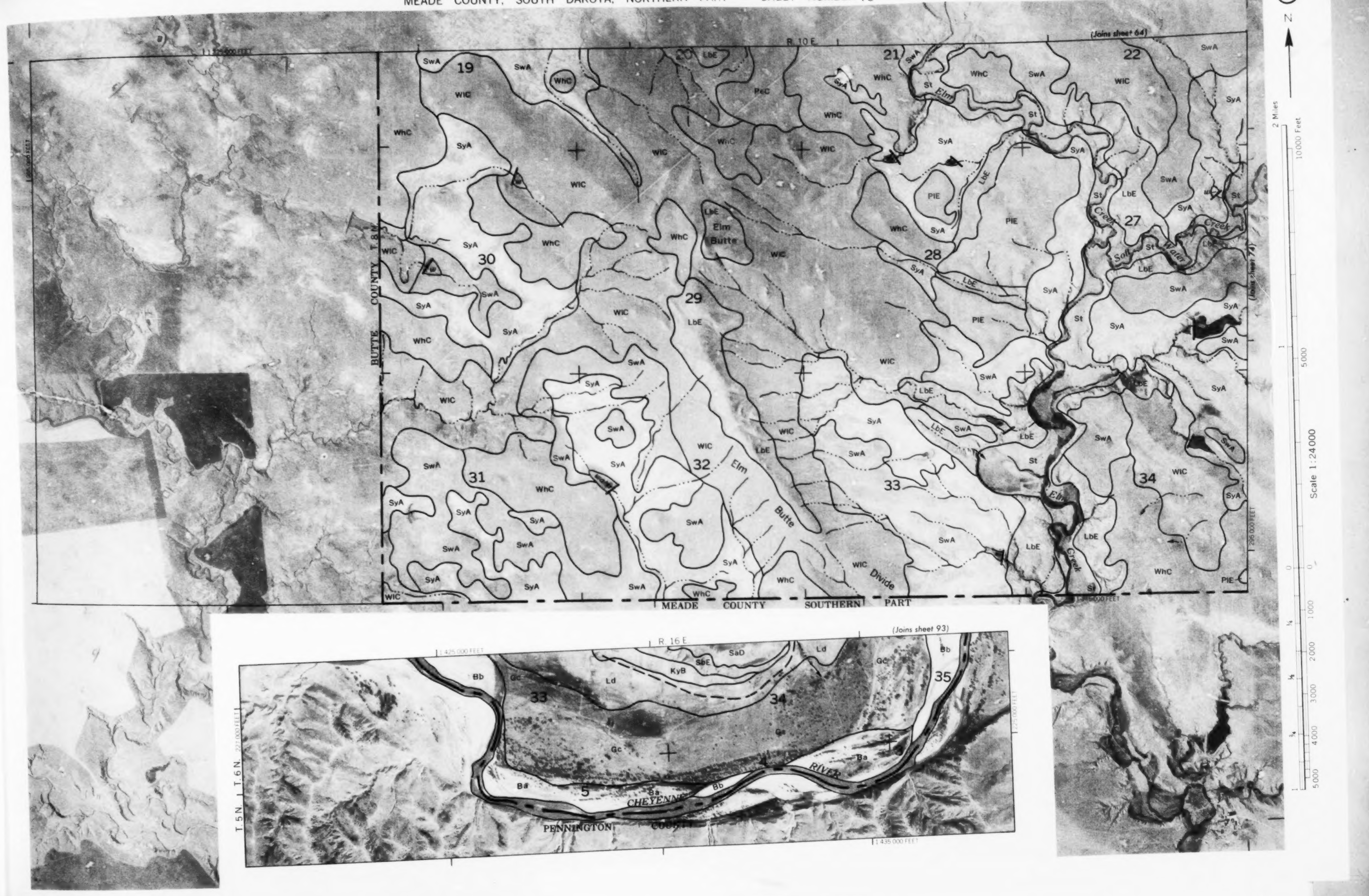

N
Scale 1:24 000
10 000 Feet
5000
0
1000
2000
3000
4000
5000
(Joins sheet 61)
(Joins sheet 69)
(Joins sheet 79)
R. 15 E.
1 420 000 FEET
1 395 000 FEET
305 000 FEET
Marcus
1
2
3
4
5
6
7
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
DeC
LcA
EgC
EgB
CaD
AlB
GaA
La
BpB
Hc
TsB
TsC
EaB
EaA
NaD
Hb
He
Ld
TdB
TdC
AsB
AtC
BmE
BpE
Owl
MbB

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 71

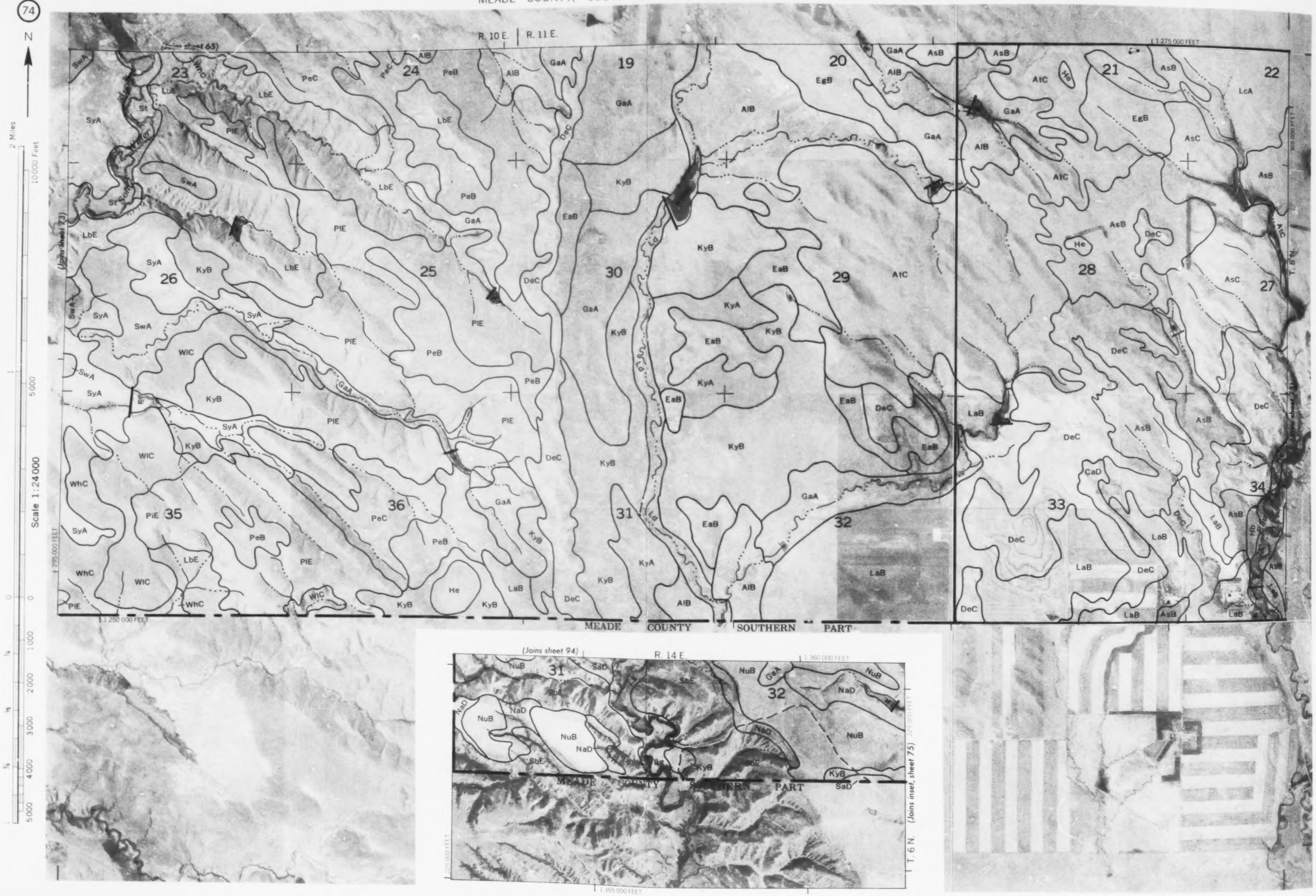

(Joins sheet 62)
R. 16 E. | R. 17 E.
1 625 000 FEET
320 000 FEET
T. 8 N.
(Joins sheet 70)
(Joins sheet 72)
(Joins sheet 80)
305 000 FEET
1 450 000 FEET
N
2 Miles
10000 Feet
Scale 1:24000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Narcelle
Creek

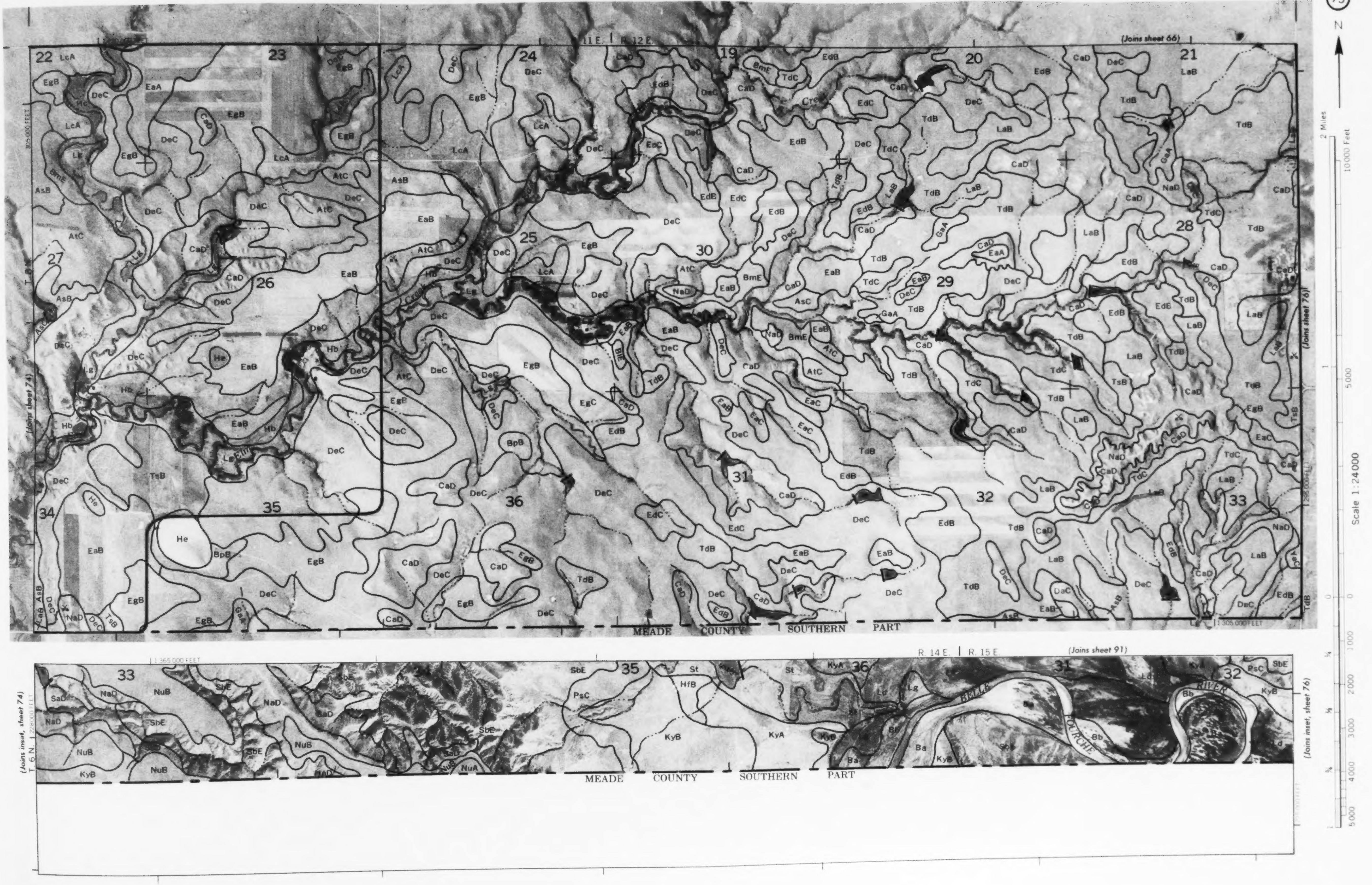
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 72


N
2 Miles
10 000 Feet
Scale 1:24 000
5000
1
0
1000
2000
3000
4000
5000
(Joins sheet 63)
(Joins sheet 71)
(Joins sheet 81)
R. 17 E.
1 475 000 FEET
1 455 000 FEET
305 000 FEET
73
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
AbB
AbC
AlB
BmE
CaD
DeC
EaB
HfB
KyA
KyB
LaB
NuB
PeB
PeC
PsC
SaD
SbE
SwA
SyA
TdB
TsB
GaA

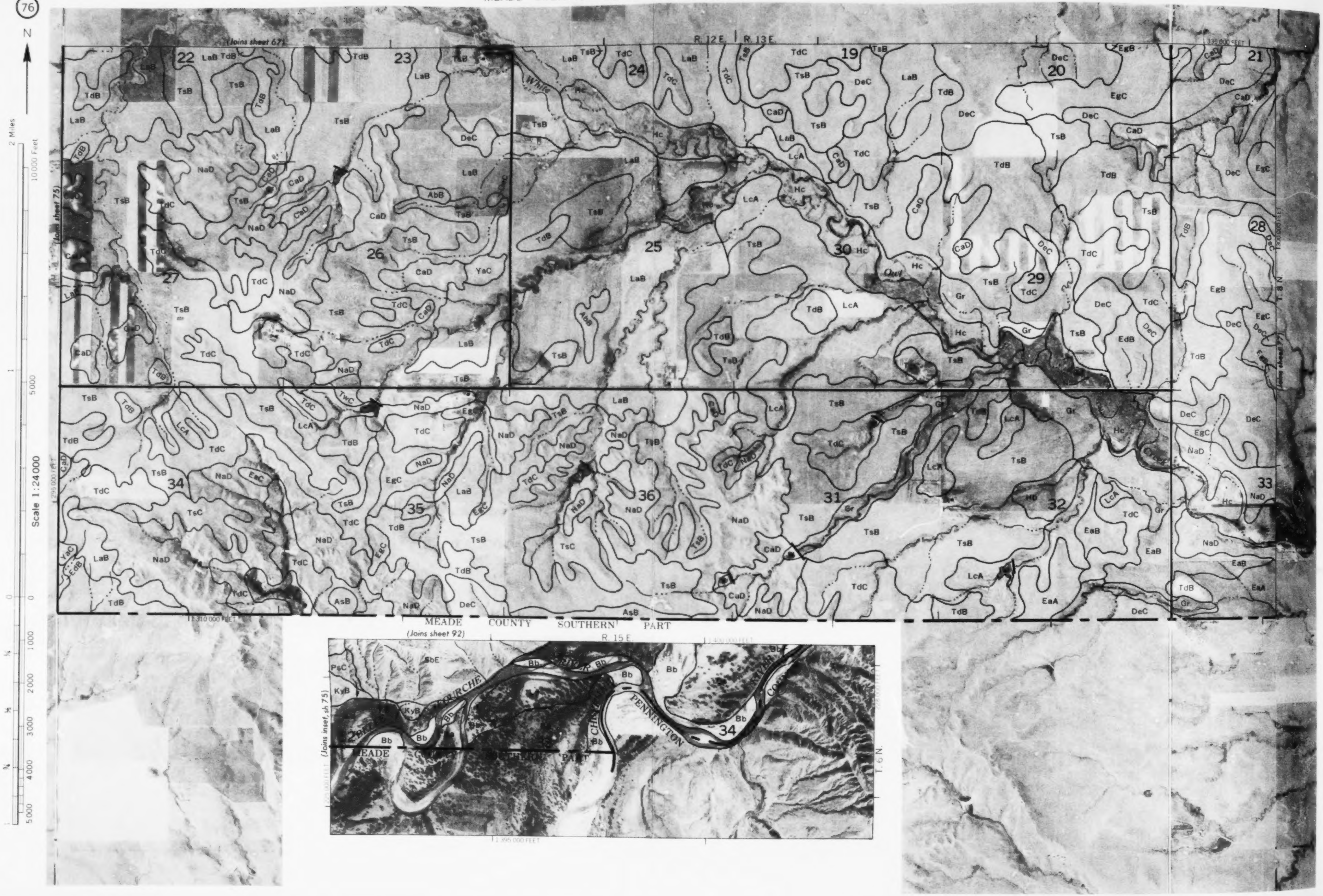

(Joins sheet 64)
R. 10 E.
BUTTE COUNTY
T. 8 N.
(Joins sheet 74)
MEADE COUNTY SOUTHERN PART
Elm Butte
Elm Butte Divide
Elm Creek
Soft Water Creek
19
20
21
22
27
28
29
30
31
32
33
34
SwA
SyA
WhC
WlC
LbE
PlE
PeC
St
(Joins sheet 93)
R. 16 E.
T. 5 N. | T. 6 N.
CHEYENNE RIVER
PENNINGTON COUNTY
33
34
35
5
4
Bb
Ba
Gc
Ld
KyB
SbE
SaD
1 425 000 FEET
1 435 000 FEET
N
2 Miles
1
0
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 74

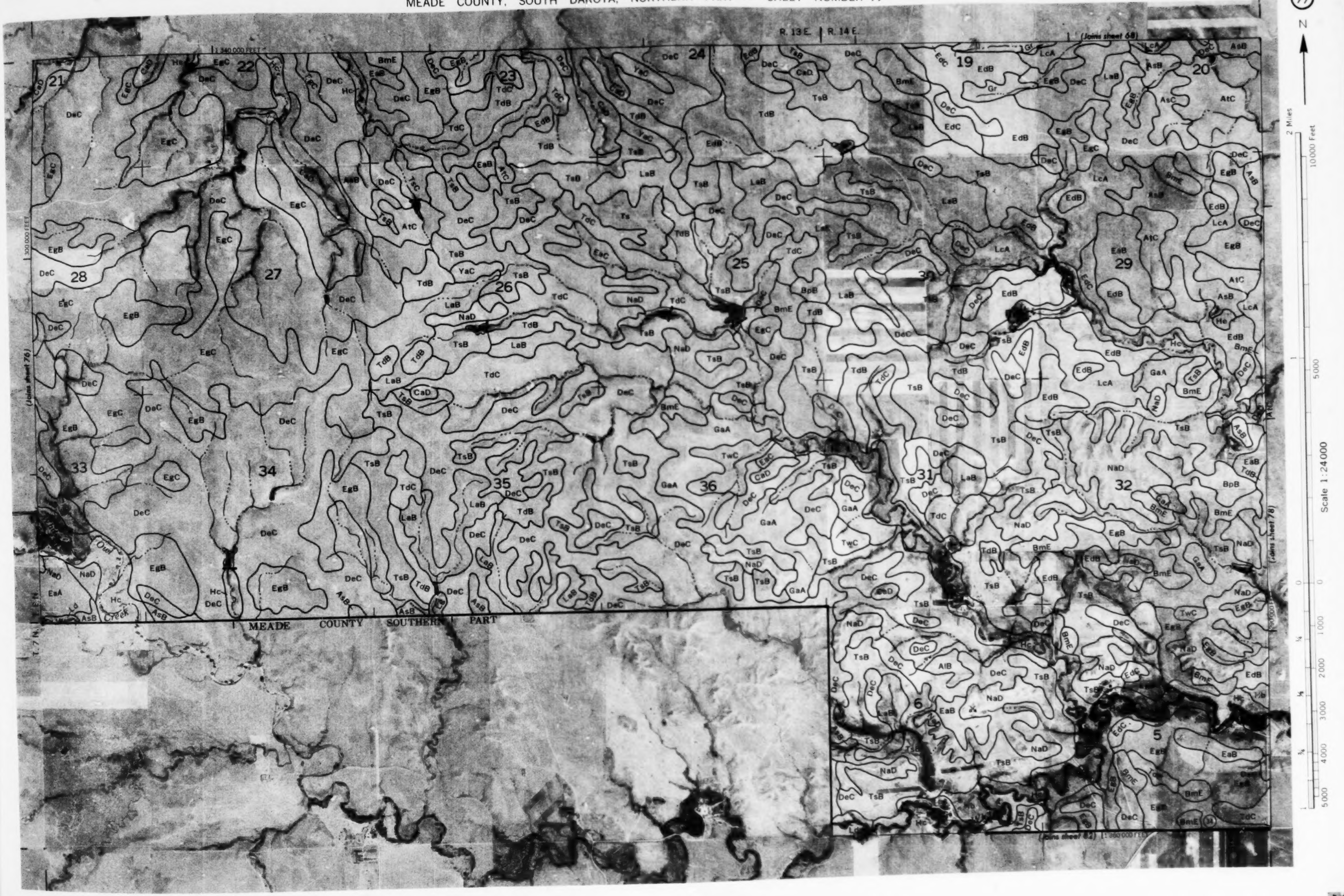

N
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
R. 10 E.
R. 11 E.
(Joins sheet 65)
(Joins sheet 73)
1 275 000 FEET
305 000 FEET
295 000 FEET
1 250 000 FEET
T. 8 N.
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
SwA
SyA
St
LbE
PlE
PeC
PeB
AlB
GaA
DeC
EaB
KyB
KyA
Ld
EgB
AsB
AtC
AsC
He
LcA
LaB
CaD
WlC
WhC
Hb
MEADE COUNTY SOUTHERN PART
(Joins sheet 94)
R. 14 E.
1 360 000 FEET
1 355 000 FEET
225 000 FEET
T. 6 N.
(Joins inset, sheet 75)
NuB
NaD
SbE
SaD


(Joins sheet 66)
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 91)
(Joins inset, sheet 74)
(Joins inset, sheet 76)
R. 11 E. | R. 12 E.
R. 14 E. | R. 15 E.
T. 6 N.
305 000 FEET
1 305 000 FEET
1 365 000 FEET
228 000 FEET
MEADE COUNTY SOUTHERN PART
22
23
24
19
20
21
27
26
25
30
29
28
34
35
36
31
32
33
BELLE FOURCHE RIVER
Creek
N
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000

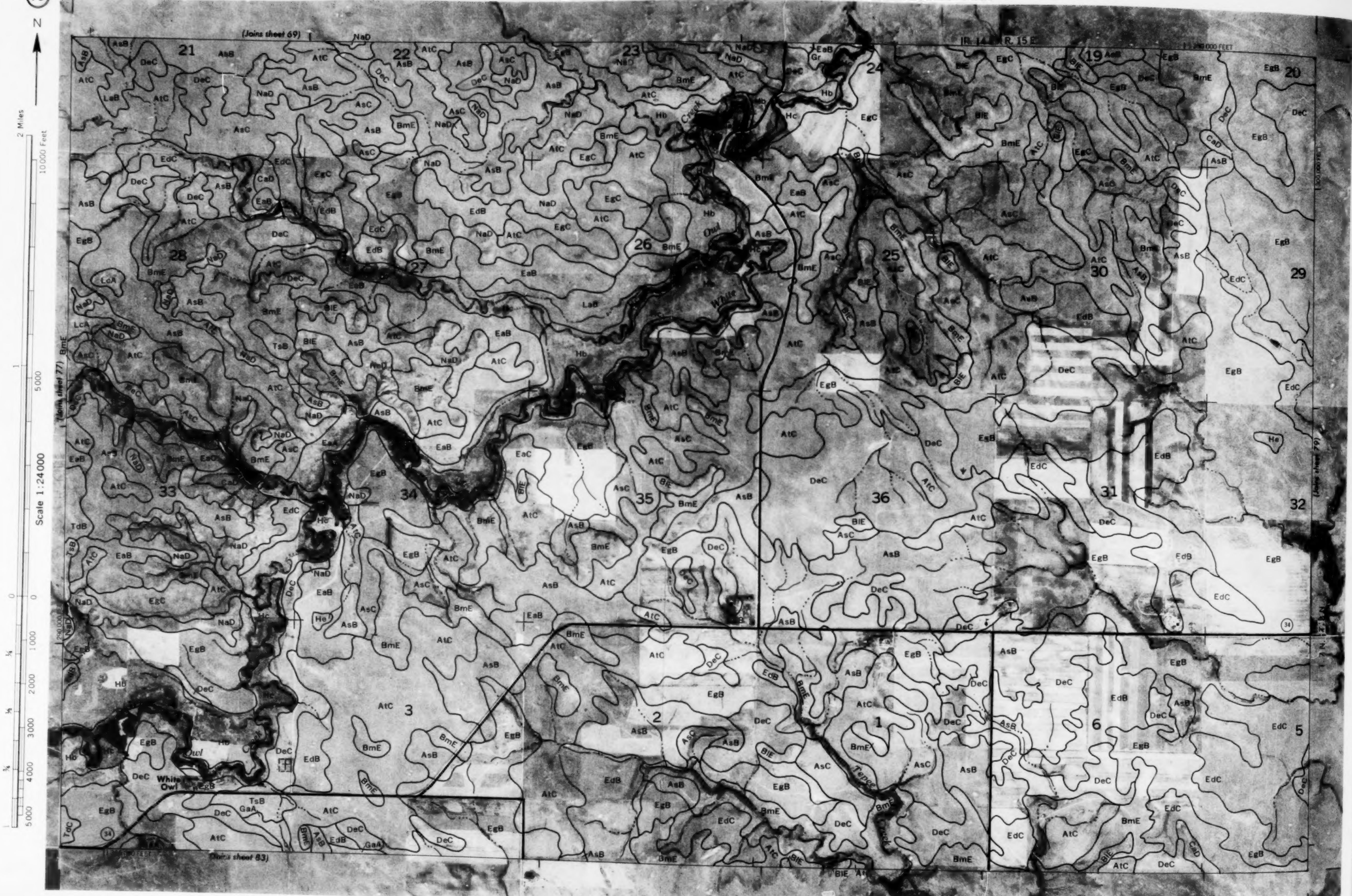
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 76


N
2 Miles
10000 Feet
5000
1
0
1000
2000
3000
4000
5000
Scale 1:24 000
(Joins sheet 67)
(Joins sheet 75)
(Joins sheet 77)
(Joins sheet 92)
(Joins inset, sh 75)
R. 12 E.
R. 13 E.
R. 15 E.
T. 8 N.
T. 6 N.
2 335 000 FEET
1 310 000 FEET
1 395 000 FEET
White
Owl
Creek
22
23
24
19
20
21
27
26
25
30
29
28
34
35
36
31
32
33
MEADE COUNTY SOUTHERN PART
BELLE FOURCHE
RIVER
CHEYENNE
PENNINGTON
CO
LaB
TdB
TsB
TdC
DeC
EgC
CaD
NaD
LcA
Hc
AbB
YaC
TwC
Gr
EdB
EaB
EaA
AsB
TsC
Hb
Bb
KyB
PsC
SbE

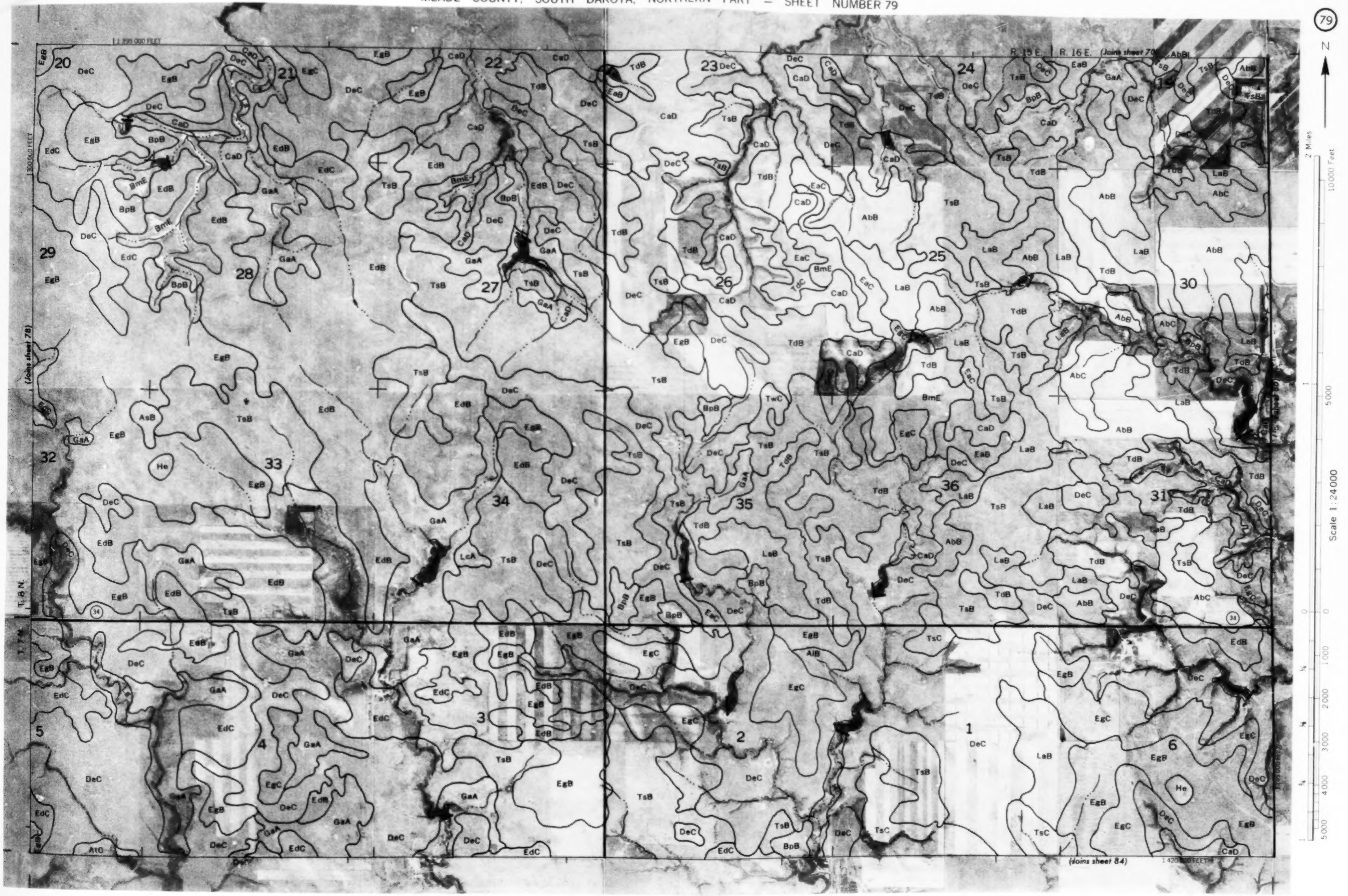
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 77


R. 13 E.
R. 14 E.
(Joins sheet 68)
(Joins sheet 76)
(Joins sheet 78)
(Joins sheet 82)
1 340 000 FEET
1 360 000 FEET
300 000 FEET
T. 7 N.
MEADE COUNTY SOUTHERN PART
Owl Creek
N
2 Miles
10000 Feet
Scale 1:24000
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
5
6

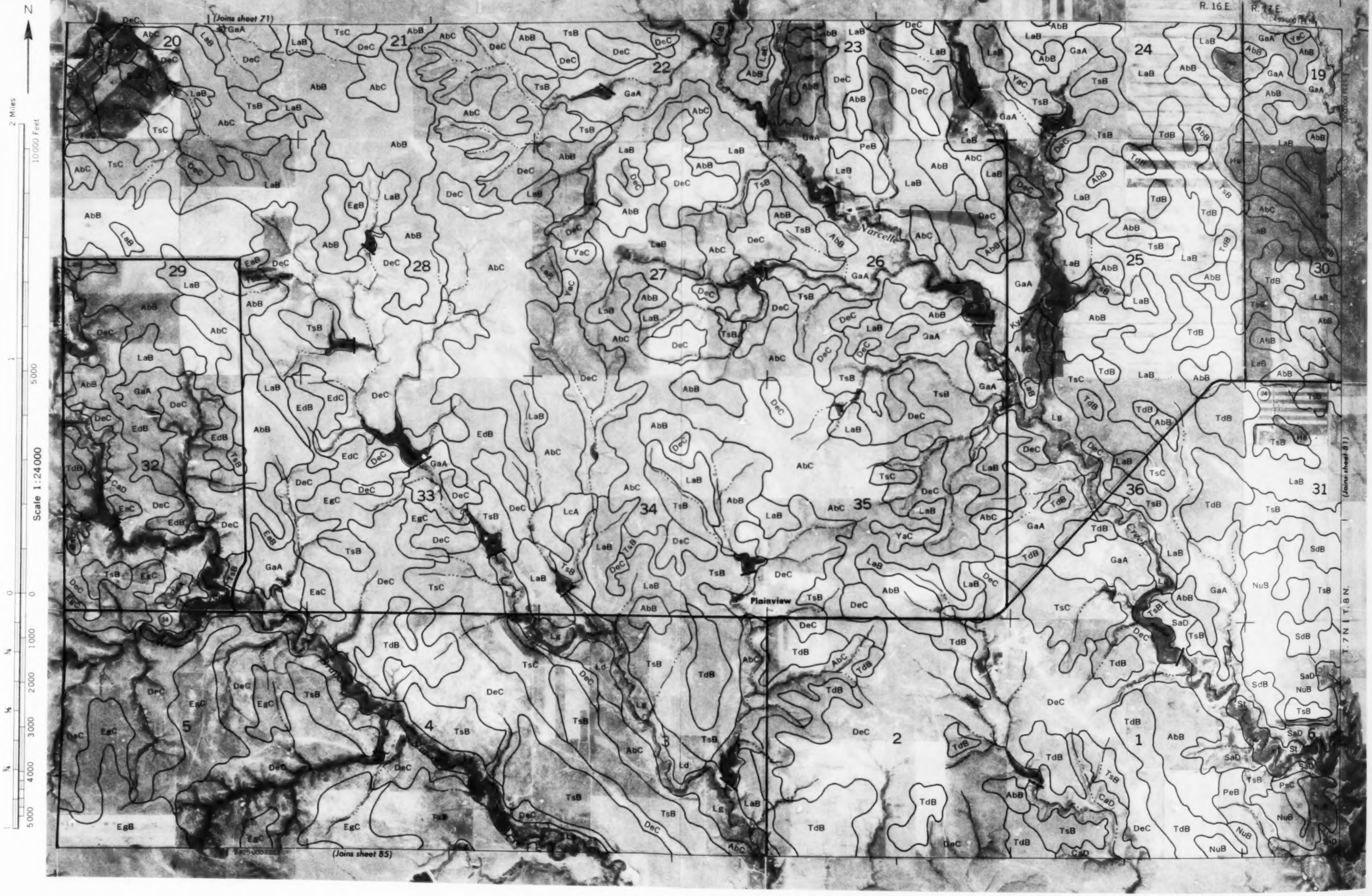
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 78

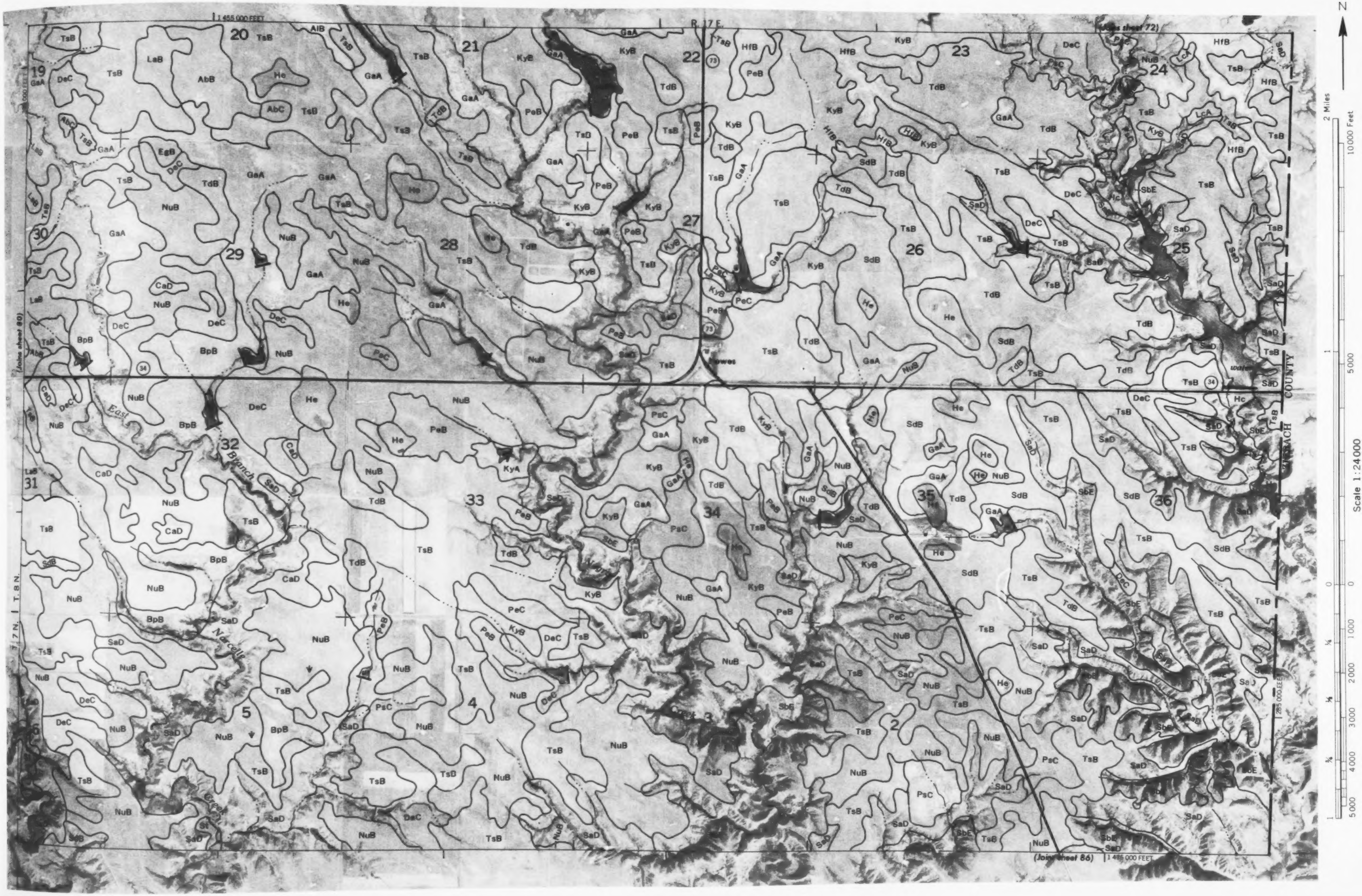

N
Scale 1:24 000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
(Joins sheet 69)
(Joins sheet 77)
(Joins sheet 79)
(Joins sheet 83)
R. 14 E. | R. 15 E.
1 290 000 FEET
T. 7 N.
34
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32
3
2
1
6
5
White Owl Creek
Owl
White
Tepee Creek
White Owl
AsB
AtC
AsC
DeC
LaB
NaD
BmE
EdC
CaD
EaB
EdB
EgB
EgC
Hb
Hc
He
Gr
BlE
LcA
TsB
TdB
TdC
EaC
GaA

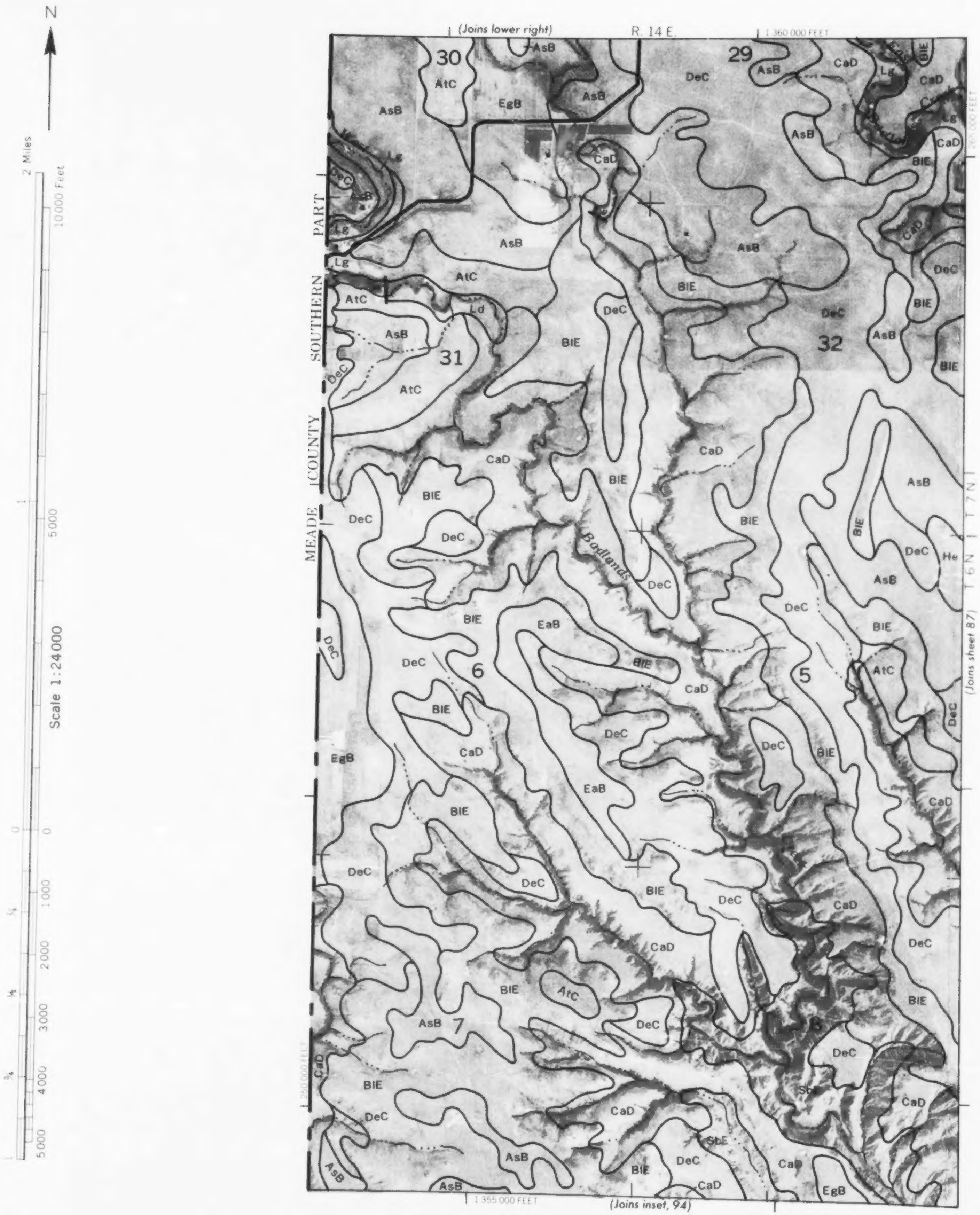
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 79

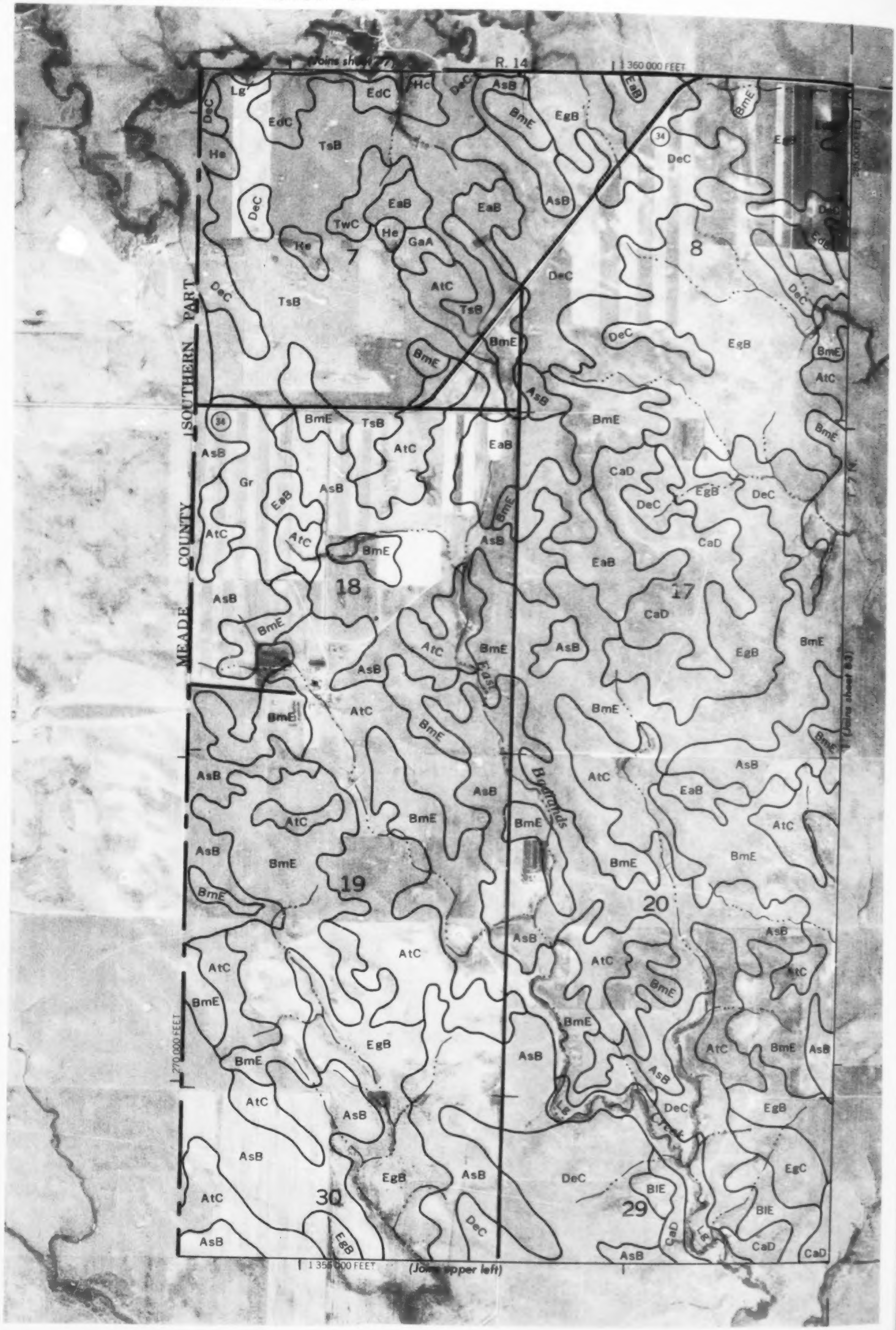

1 395 000 FEET
R. 15 E.
R. 16 E.
(Joins sheet 70)
(Joins sheet 78)
(joins sheet 84)
(Joins sheet 80)
300 000 FEET
1 420 000 FEET
T. 8 N.
T. 7 N.
34
N
2 Miles
10 000 Feet
Scale 1:24 000
0
1000
2000
3000
4000
5000
20
21
22
23
24
19
29
28
27
26
25
30
32
33
34
35
36
31
5
4
3
2
1
6

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 80

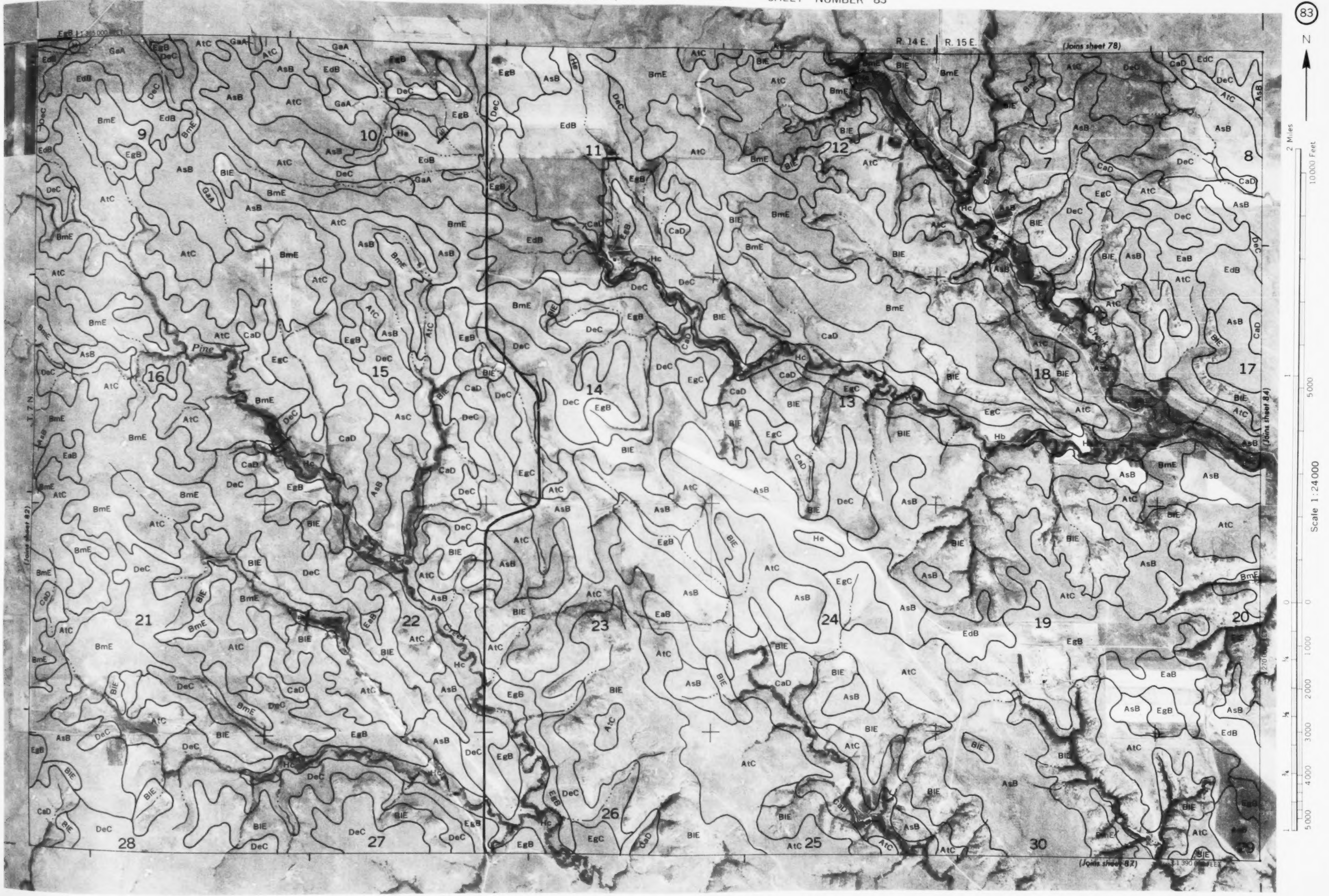

N
2 Miles
10000 Feet
5000
0
Scale 1:24000
1000
2000
3000
4000
5000
(Joins sheet 71)
(Joins sheet 85)
(Joins sheet 81)
R. 16 E.
R. 17 E.
T. 7 N.
T. 8 N.
Plainview
Narcelle
Creek
34
20
21
22
23
24
19
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
AbB
AbC
DeC
LaB
TsB
TsC
GaA
TdB
EdB
EdC
EgC
EgB
EaC
CaD
YaC
PeB
NuB
SdB
SaD
St
PsC
LcA
Lg
Ld
Kyr
Hv


N
1 455 000 FEET
R. 17 E.
(Joins sheet 72)
(Joins sheet 80)
(Joins sheet 86)
1 485 000 FEET
285 000 FEET
T. 8 N.
T. 7 N.
20
21
22
23
24
19
30
29
28
27
26
25
32
33
34
35
36
31
5
4
3
2
East Branch
Narcelle Creek
Creek
73
34
Howes
COUNTY
ZIEBACH
2 Miles
10000 Feet
1
5000
0
0
1000
¼
2000
½
3000
¾
4000
1
5000
Scale 1:24000

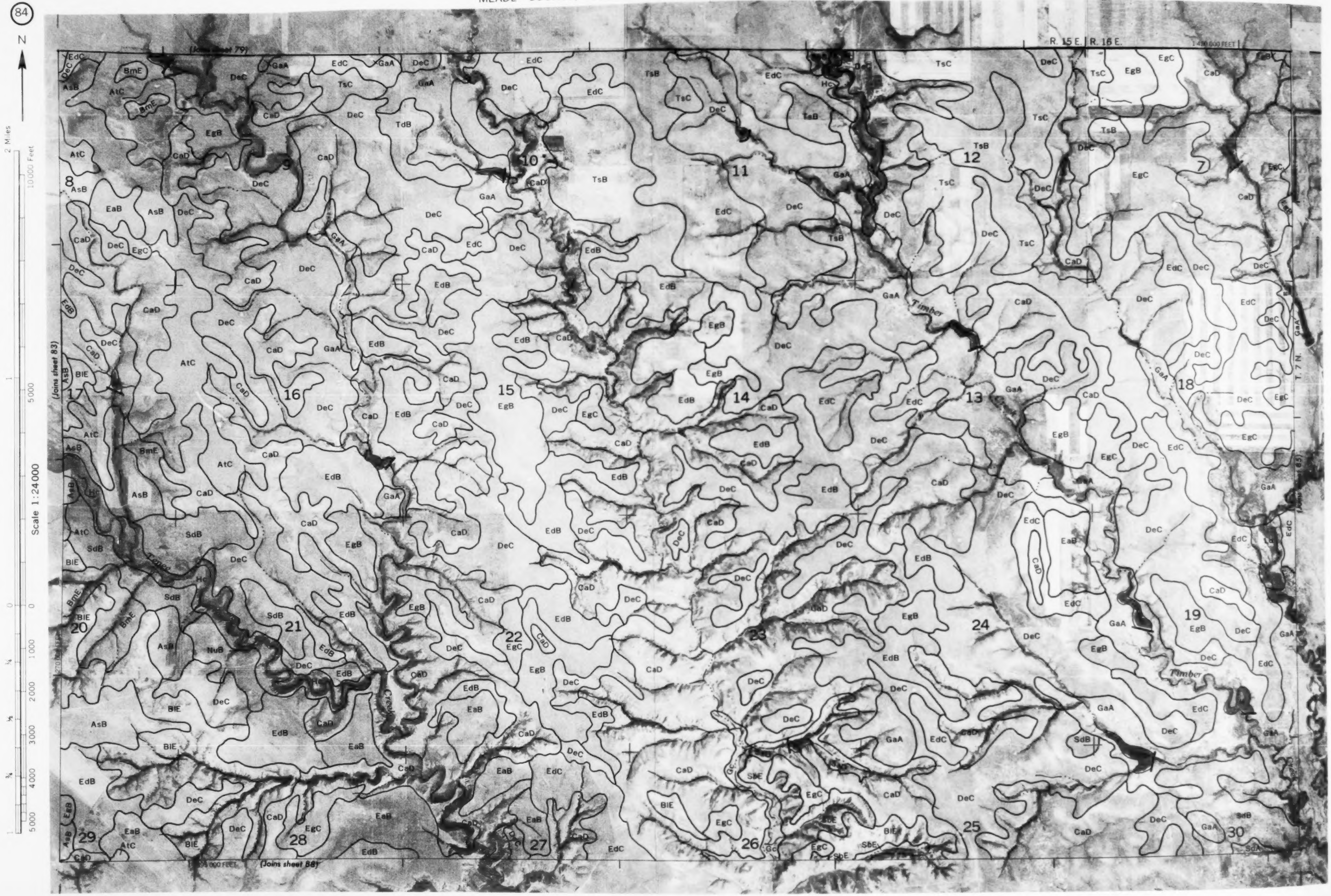

N
Scale 1:24000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
(Joins lower right)
R. 14 E.
1 360 000 FEET
(Joins sheet 87)
(Joins inset, 94)
1 355 000 FEET
MEADE COUNTY SOUTHERN PART
T 7 N
T 6 N
Badlands
30
29
31
32
6
5
7
8
AsB
AtC
EgB
DeC
CaD
BlE
Lg
Ld
He
EaB
SbF


(Joins sheet 77)
R. 14
1 360 000 FEET
(Joins sheet 83)
(Joins upper left)
1 355 000 FEET
270 000 FEET
MEADE COUNTY SOUTHERN PART
T 7 N
34
Badlands
Elm Creek
7
8
18
17
19
20
30
29
AsB
AtC
BmE
DeC
EdC
EgB
EaB
GaA
Gr
Hc
He
Lg
TsB
TwC
CaD
BlE
EgC

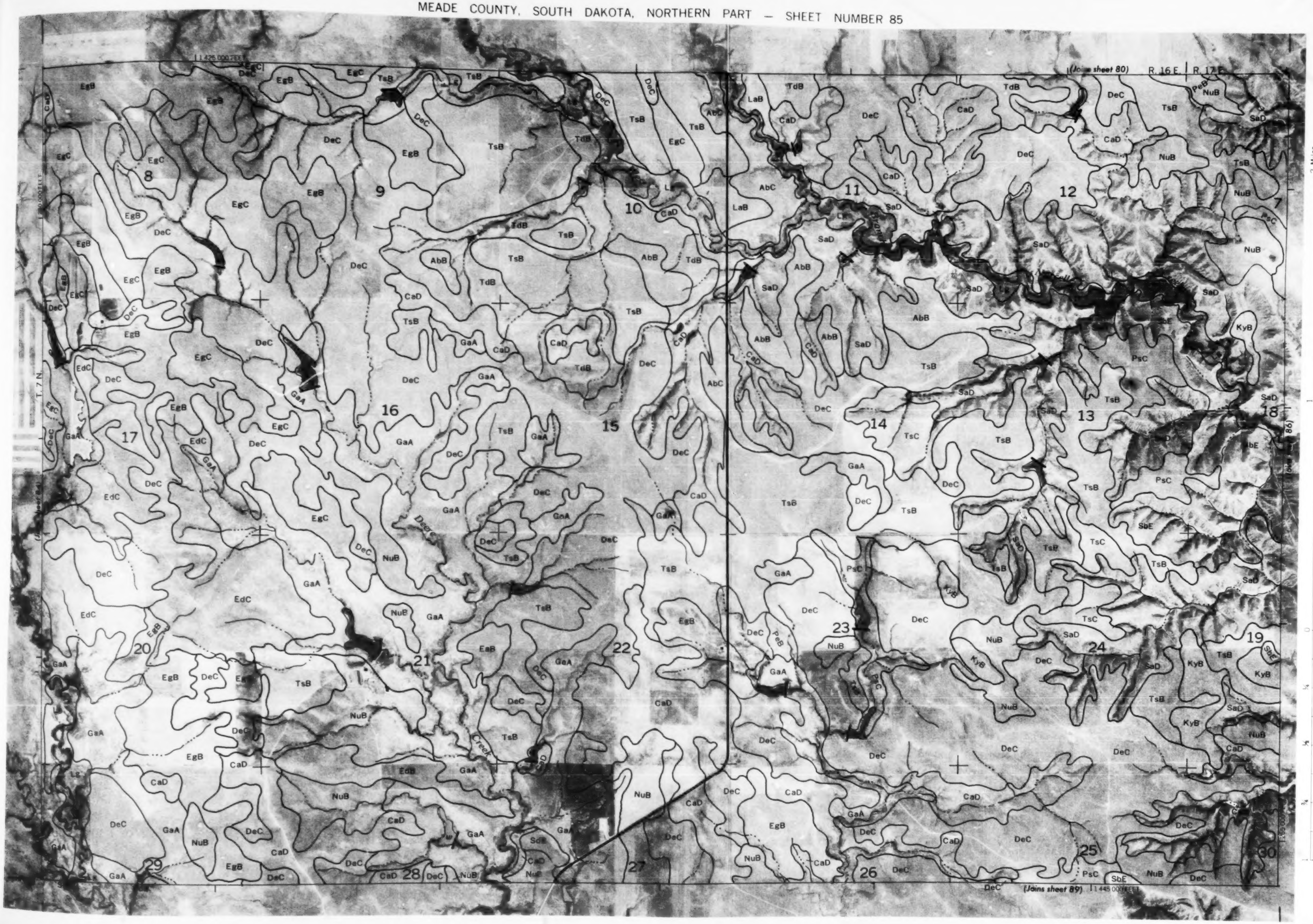
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 83


83
N
(Joins sheet 78)
(Joins sheet 84)
(Joins sheet 87)
(Joins sheet 82)
R. 14 E.
R. 15 E.
T. 7 N.
1 385 000 FEET
1 390 000 FEET
Pine
Creek
Creek
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
AsB
AsC
AtC
BlE
BmE
CaD
DeC
EaB
EdB
EdC
EgB
EgC
GaA
Hb
Hc
He
2 Miles
10 000 Feet
5000
1
0
0
¼
1000
2000
½
3000
¾
4000
5000
1
Scale 1:24 000

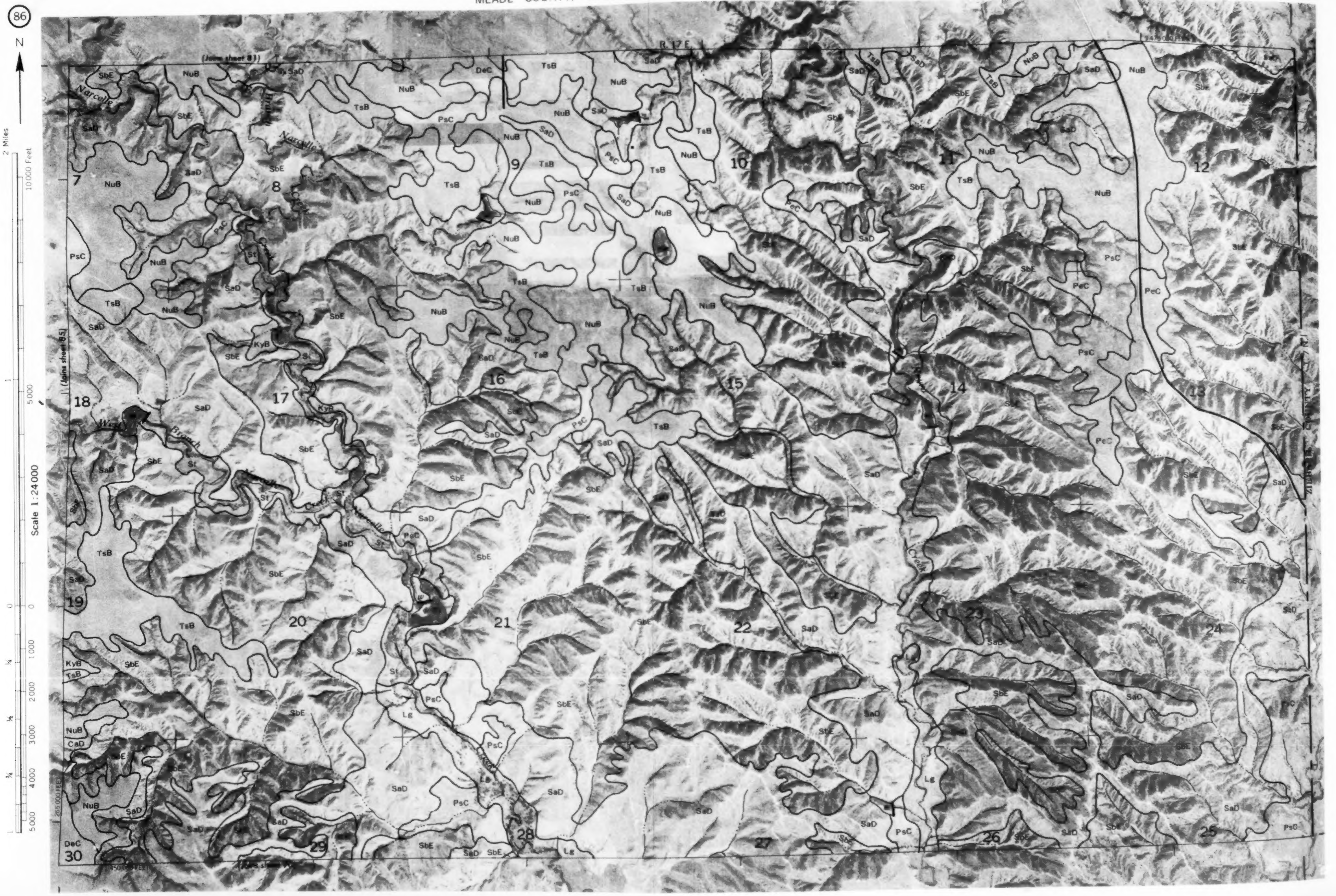
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 84


N
2 Miles
10000 Feet
Scale 1:24 000
(Joins sheet 79)
(Joins sheet 83)
(Joins sheet 85)
(Joins sheet 88)
R. 15 E. | R. 16 E.
T. 7 N.
Timber
Creek
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 85

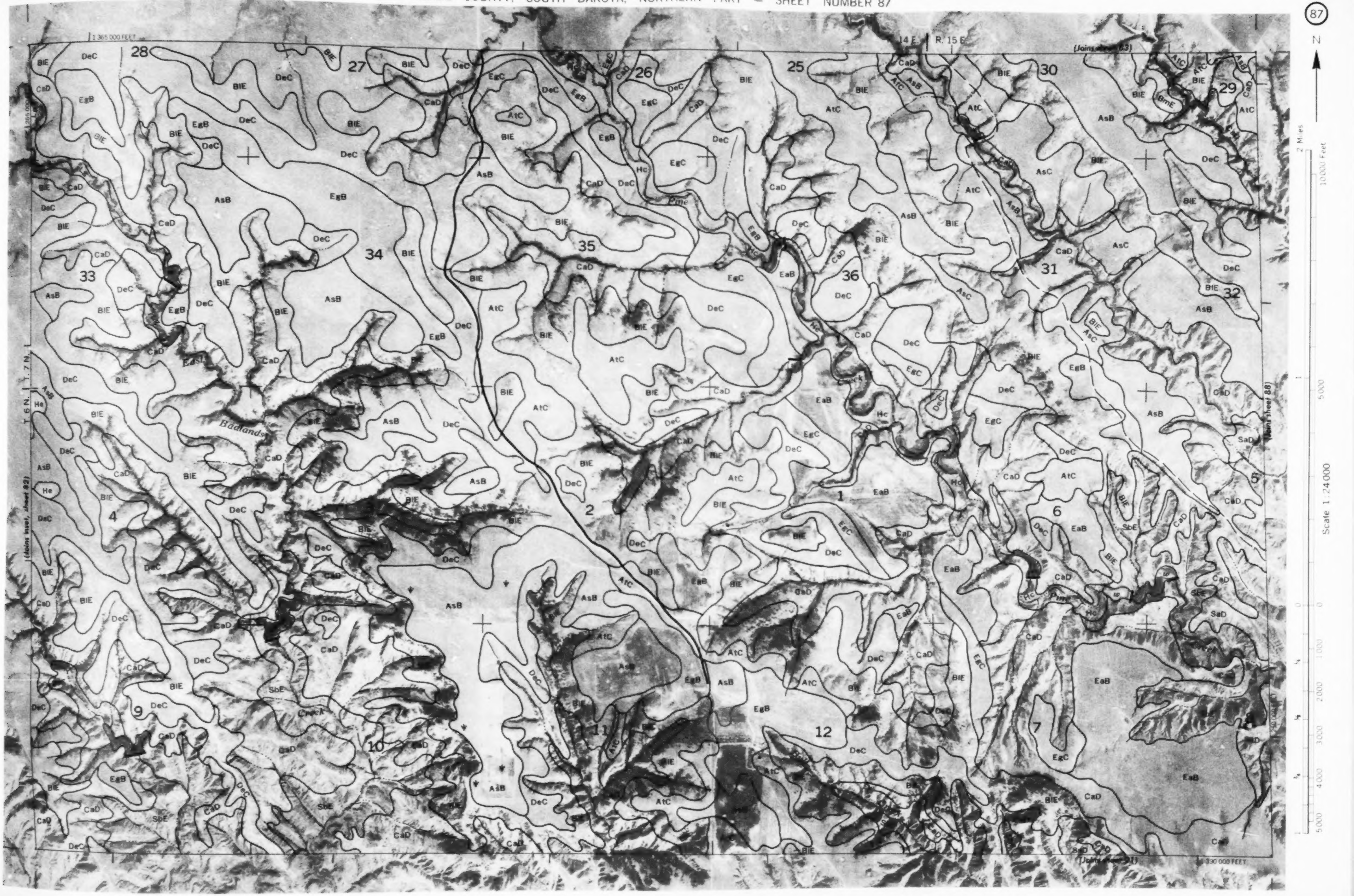

(Joins sheet 80)
R. 16 E.
R. 17 E.
N
T. 7 N.
(Joins sheet 89)
1 425 000 FEET
1 445 000 FEET
Creek
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
EgB
EgC
DeC
TsB
TdB
CaD
AbB
AbC
LaB
SaD
NuB
PeB
PsC
KyB
SbE
EdC
GaA
TsC
EdB
Scale 1:24000
2 Miles
10000 Feet
5000
1000
2000
3000
4000
0
1
¼
½
¾

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 86

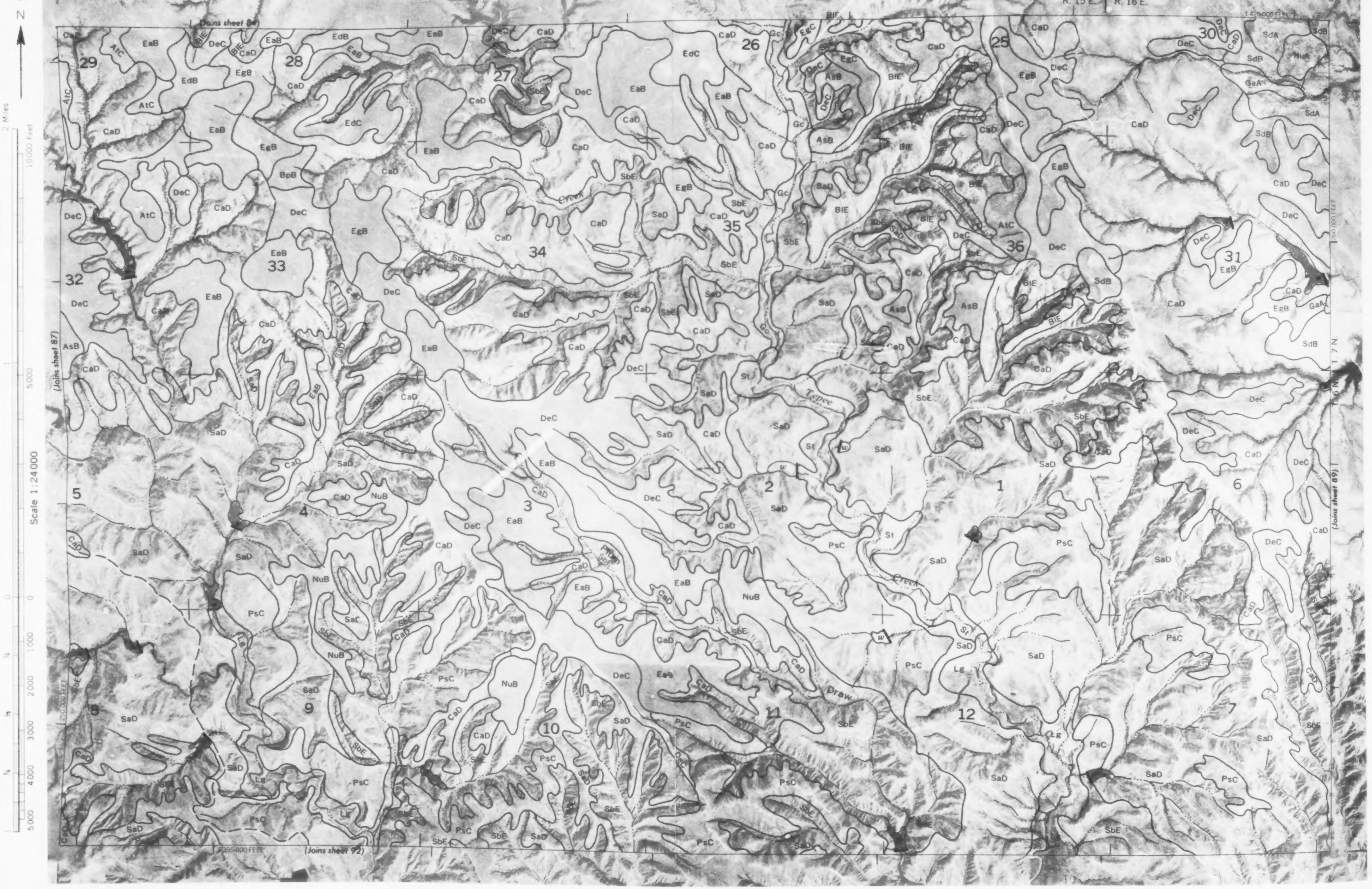


86
N
2 Miles
10 000 Feet
1
5000
Scale 1:24 000
0
0
¼
1000
2000
½
3000
¾
4000
5000
(Joins sheet 81)
(Joins sheet 85)
R. 17 E.
Narcelle Creek
West Branch Narcelle Creek
Creek
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
SbE
SaD
NuB
TsB
PsC
PeC
DeC
KyB
St
Lg
CaD

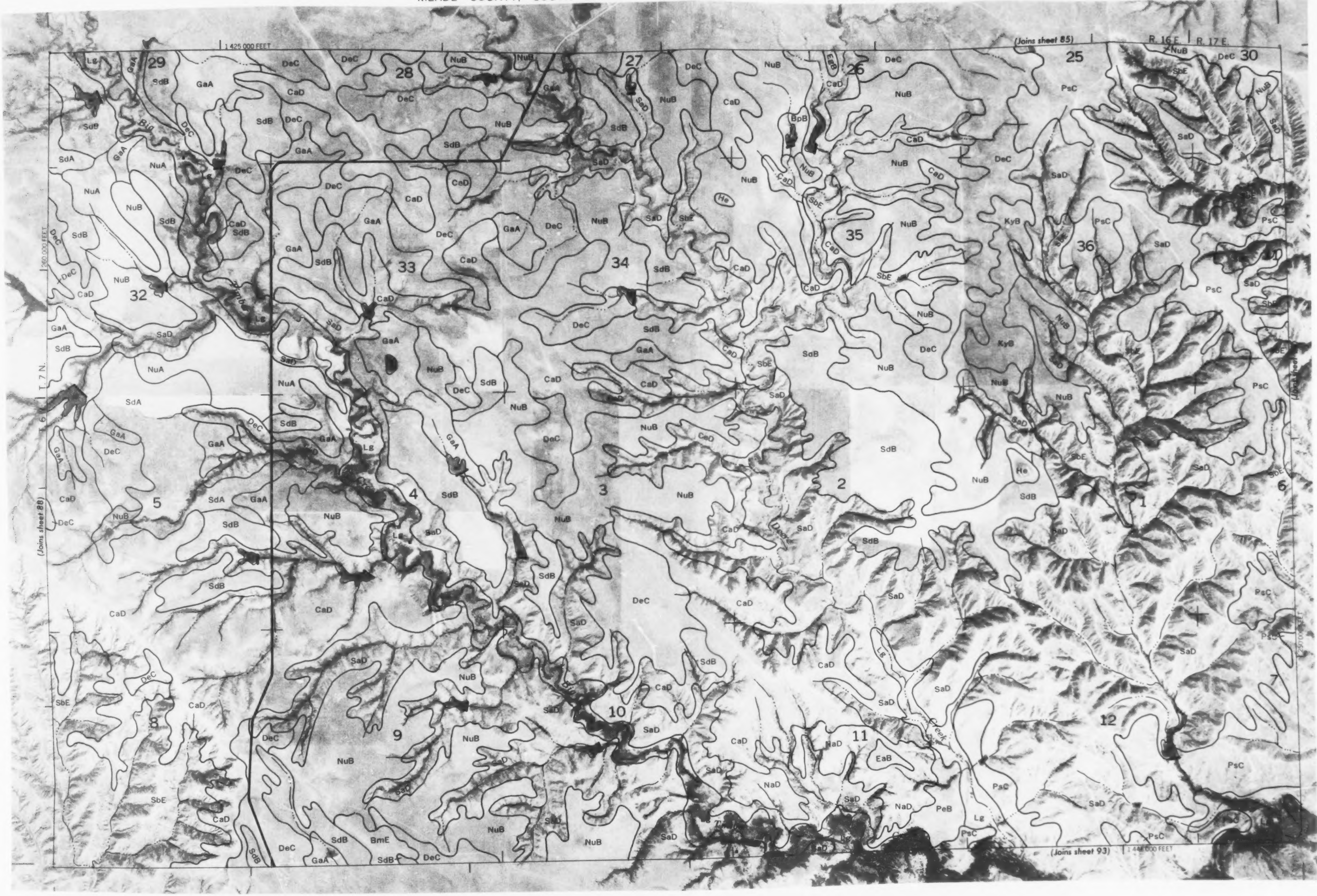
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 87

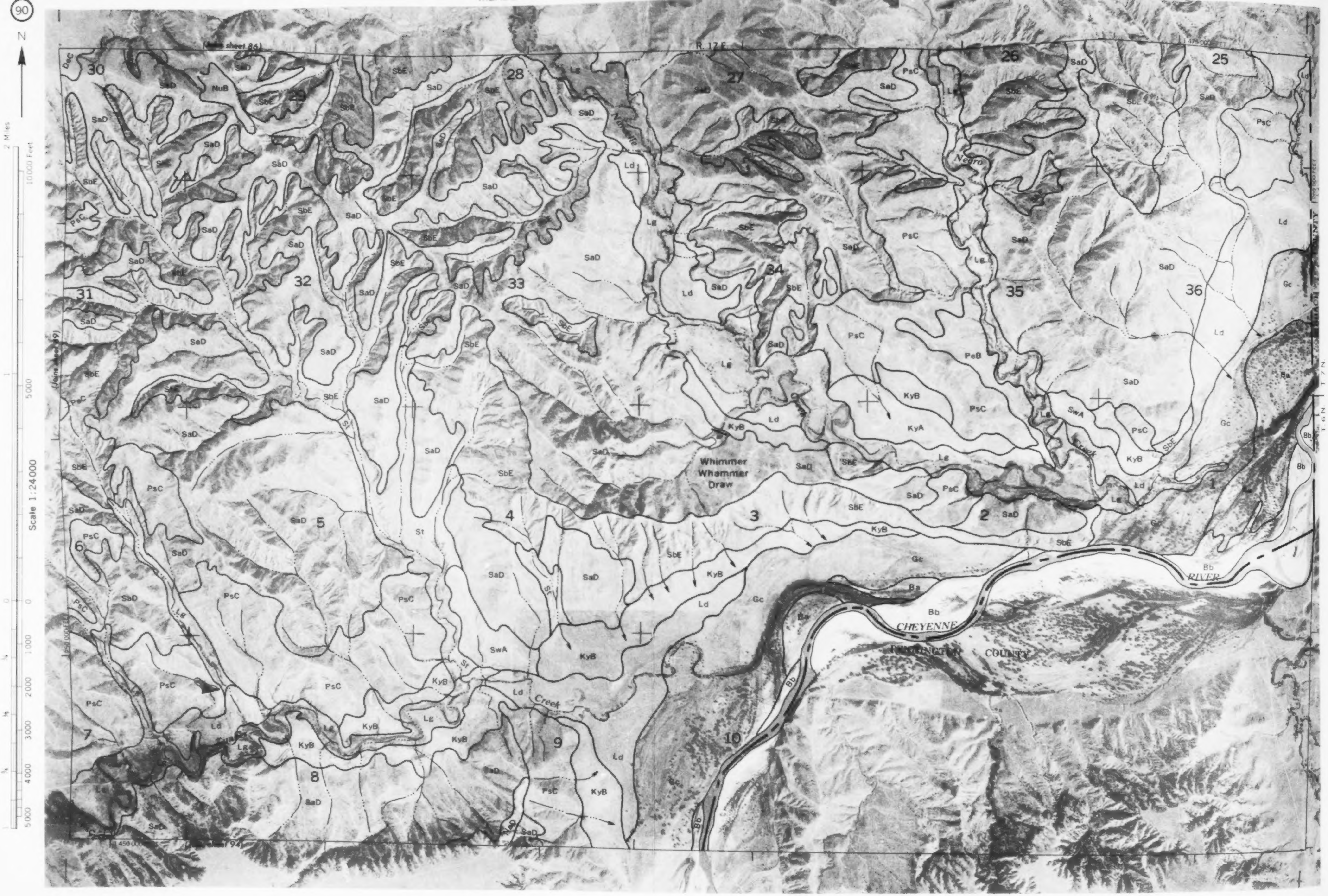

1 365 000 FEET
R. 14 E. | R. 15 E.
(Joins sheet 83)
(Joins sheet 82)
(Joins sheet 88)
(Joins sheet 91)
1 330 000 FEET
T. 7 N.
T. 6 N.
N
2 Miles
10 000 Feet
Scale 1:24 000
East
Badlands
Pine
Creek
28
27
26
25
30
29
33
34
35
36
31
32
4
2
1
6
5
9
10
11
12
7
BlE
DeC
CaD
EgB
EgC
AsB
AsC
AtC
BmE
Hc
He
EaB
SbE
SaD

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 88

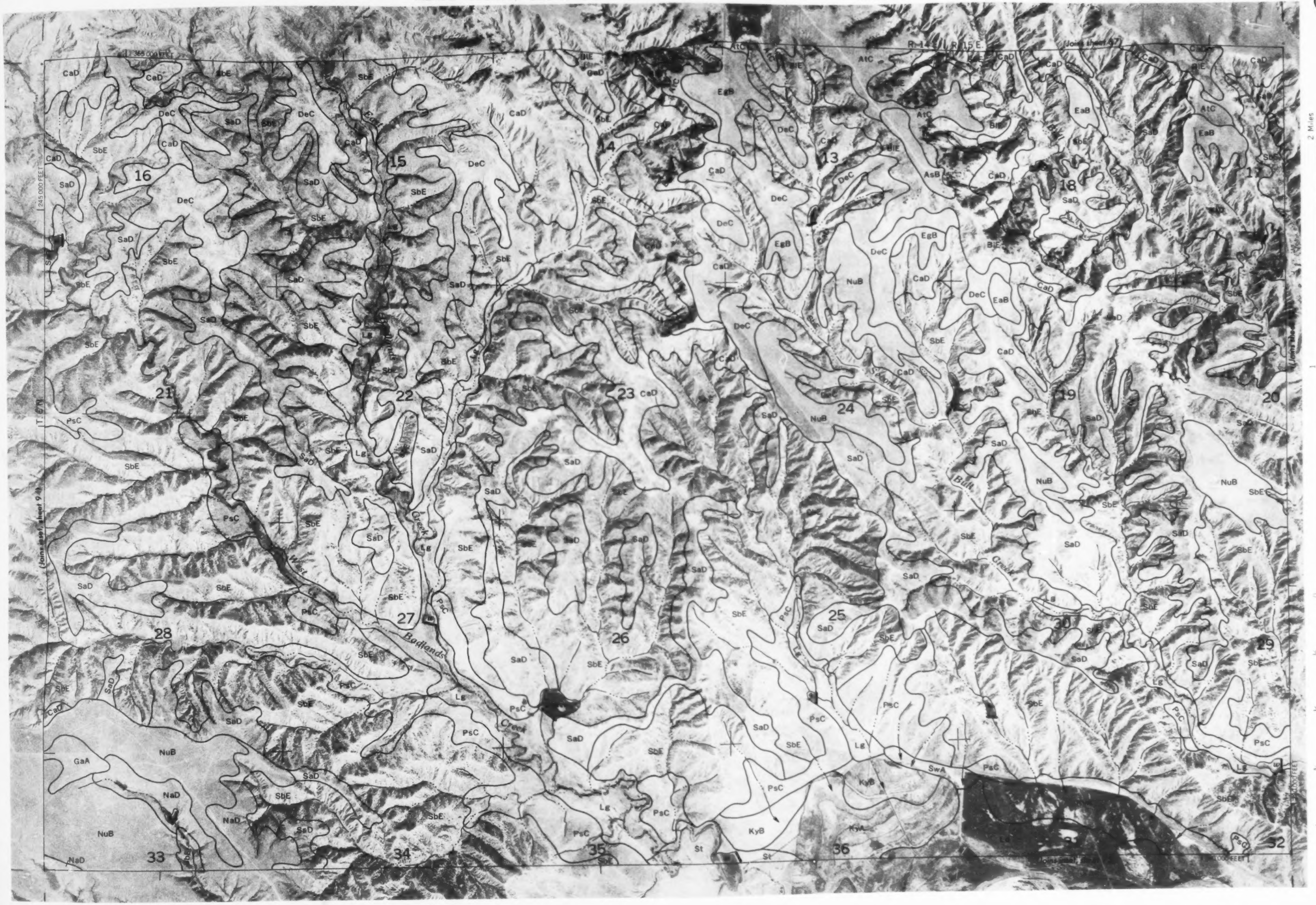

N
2 Miles
10 000 Feet
5000
0
Scale 1:24 000
1000
2000
3000
4000
5000
R. 15 E.
R. 16 E.
1 420 000 FEET
T. 7 N.
T. 6 N.
295 000 FEET
250 000 FEET
(Joins sheet 84)
(Joins sheet 87)
(Joins sheet 89)
(Joins sheet 92)
29
28
27
26
25
30
32
33
34
35
36
31
5
4
3
2
1
6
8
9
10
11
12
7
Creek
Tepee
Plum
Creek
Draw
CaD
AtC
EaB
BlE
DeC
EdB
EgB
EdC
SbE
EgC
AsB
Gc
NuA
SdA
SdB
GaA
BpB
SaD
St
NuB
PsC
SaC
Lg
w

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 89

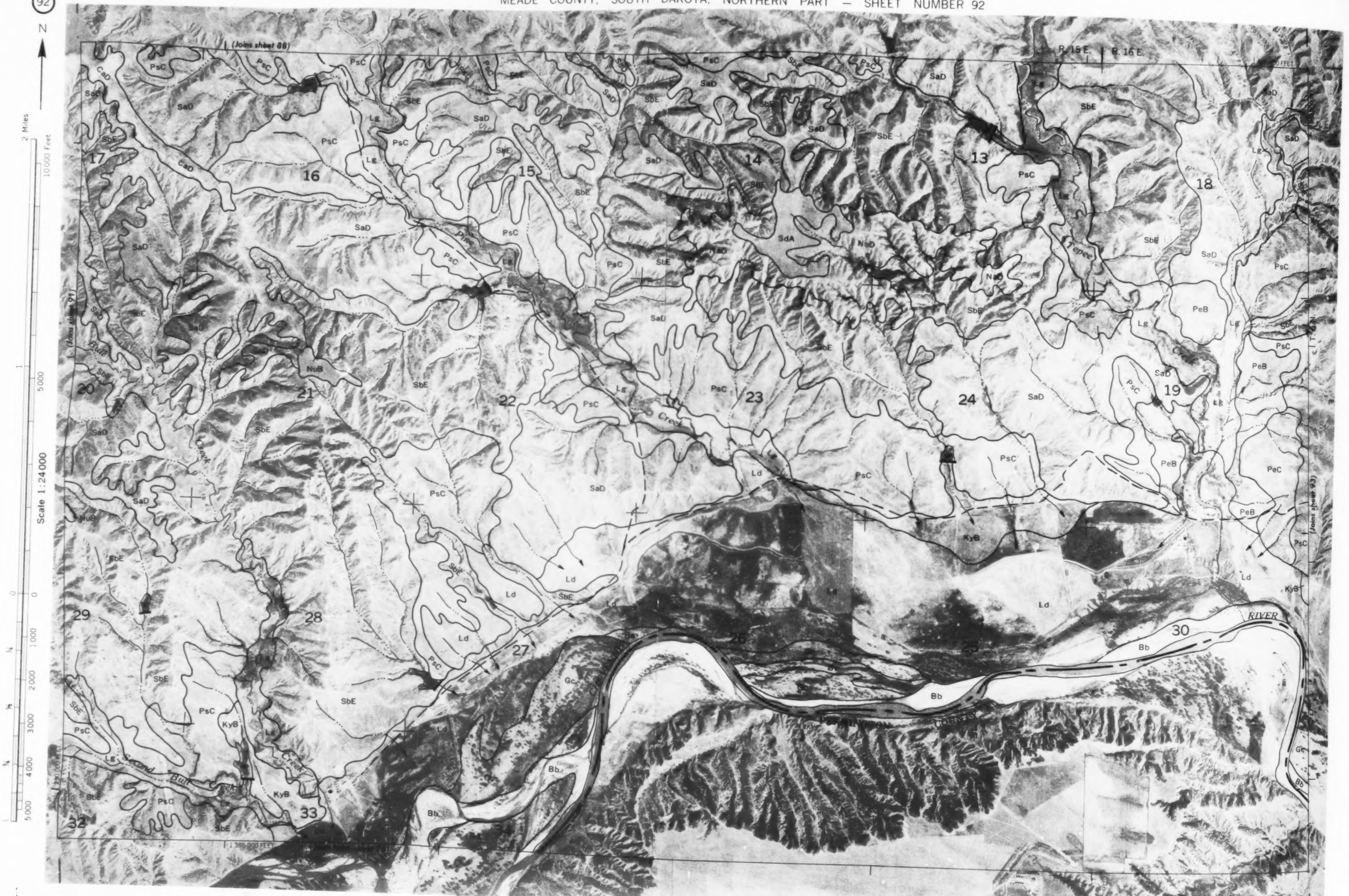

1 425 000 FEET
(Joins sheet 85)
R. 16 E.
R. 17 E.
T. 7 N.
T. 6 N.
260 000 FEET
(Joins sheet 88)
(Joins sheet 93)
1 445 000 FEET
2 Miles
1
0
25
26
27
28
29
30
31
32
33
34
35
36
1
2
3
4
5
6
7
8
9
10
11
12
Big
Bear
Deep
Creek
Lg
GaA
SdB
DeC
CaD
NuB
NuA
SdA
SaD
SbE
EaB
BpB
He
KyB
PsC
NaD
PeB
BmE


N
2 Miles
10000 Feet
5000
0
Scale 1:24000
1000
2000
3000
4000
5000
(Joins sheet 84)
(Joins sheet 89)
(Joins sheet 94)
R. 17 E.
T. 7 N.
T. 6 N.
30
29
28
27
26
25
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
Nowlin
Negro
Creek
Whimmer Whammer Draw
CHEYENNE
RIVER
PENNINGTON COUNTY
SaD
SbE
PsC
PsB
NuB
DeC
Ld
Lg
St
KyB
KyA
SwA
Gc
Ba
Bb

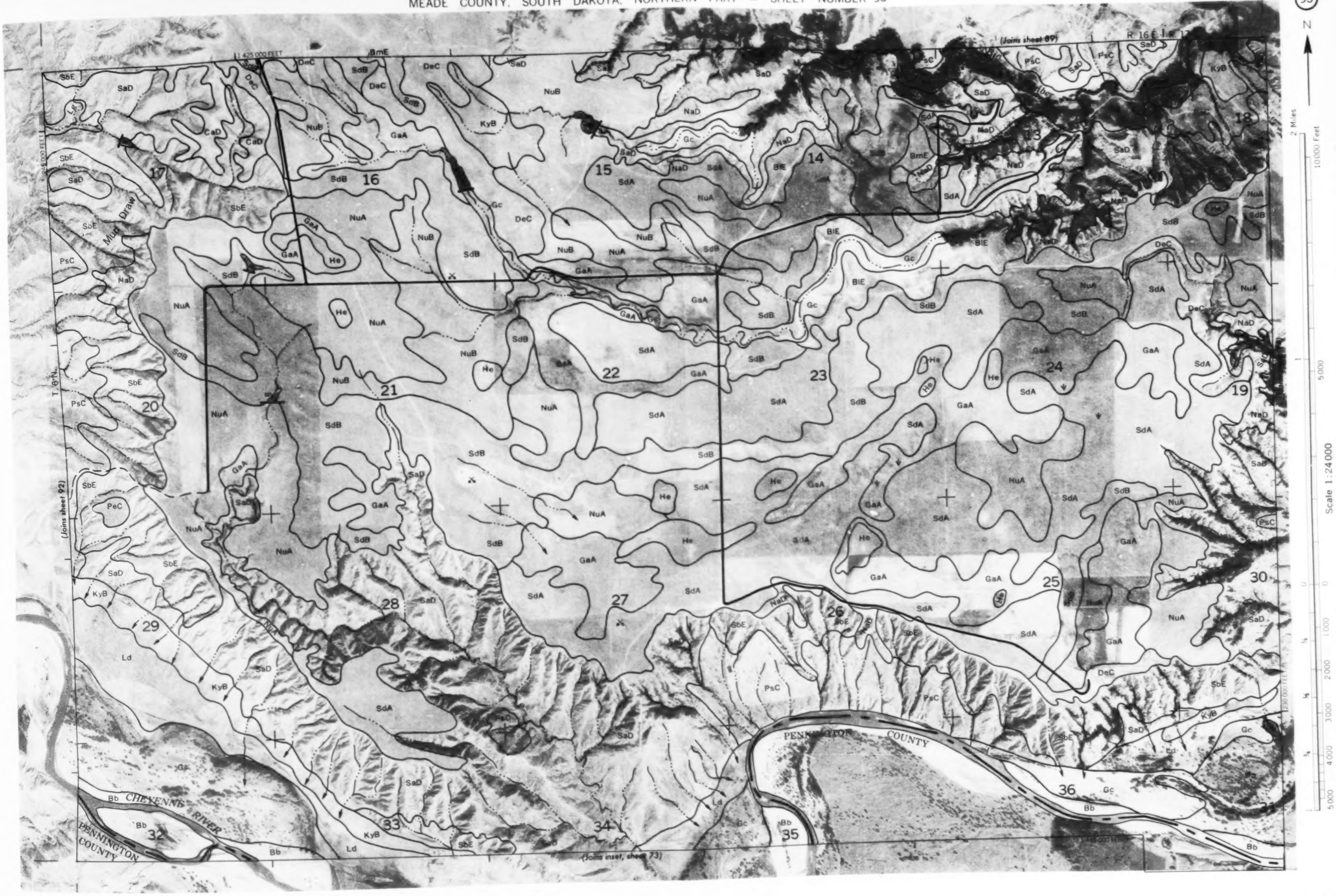
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 91

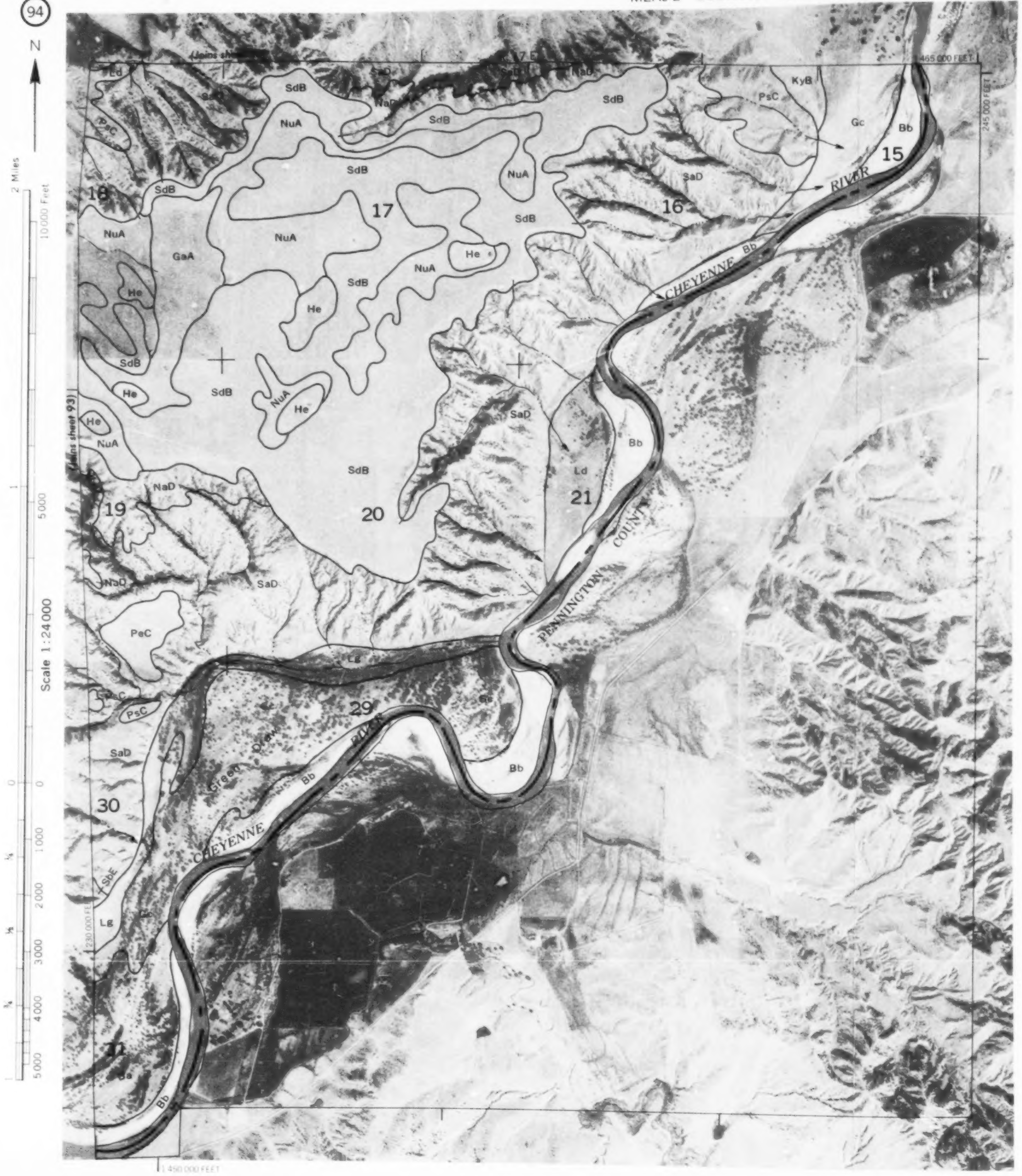

Joins sheet 67
R. 14 E.
R. 15 E.
365 000 FEET
245 000 FEET
T. 8 N.
2 Miles
1
0
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
East
West
Creek
Badlands
Bull
Creek
CaD
SbE
SaD
DeC
BlE
AtC
EgB
EaB
AsB
NuB
PsC
Lg
GaA
NaD
KyB
KyA
St
SwA

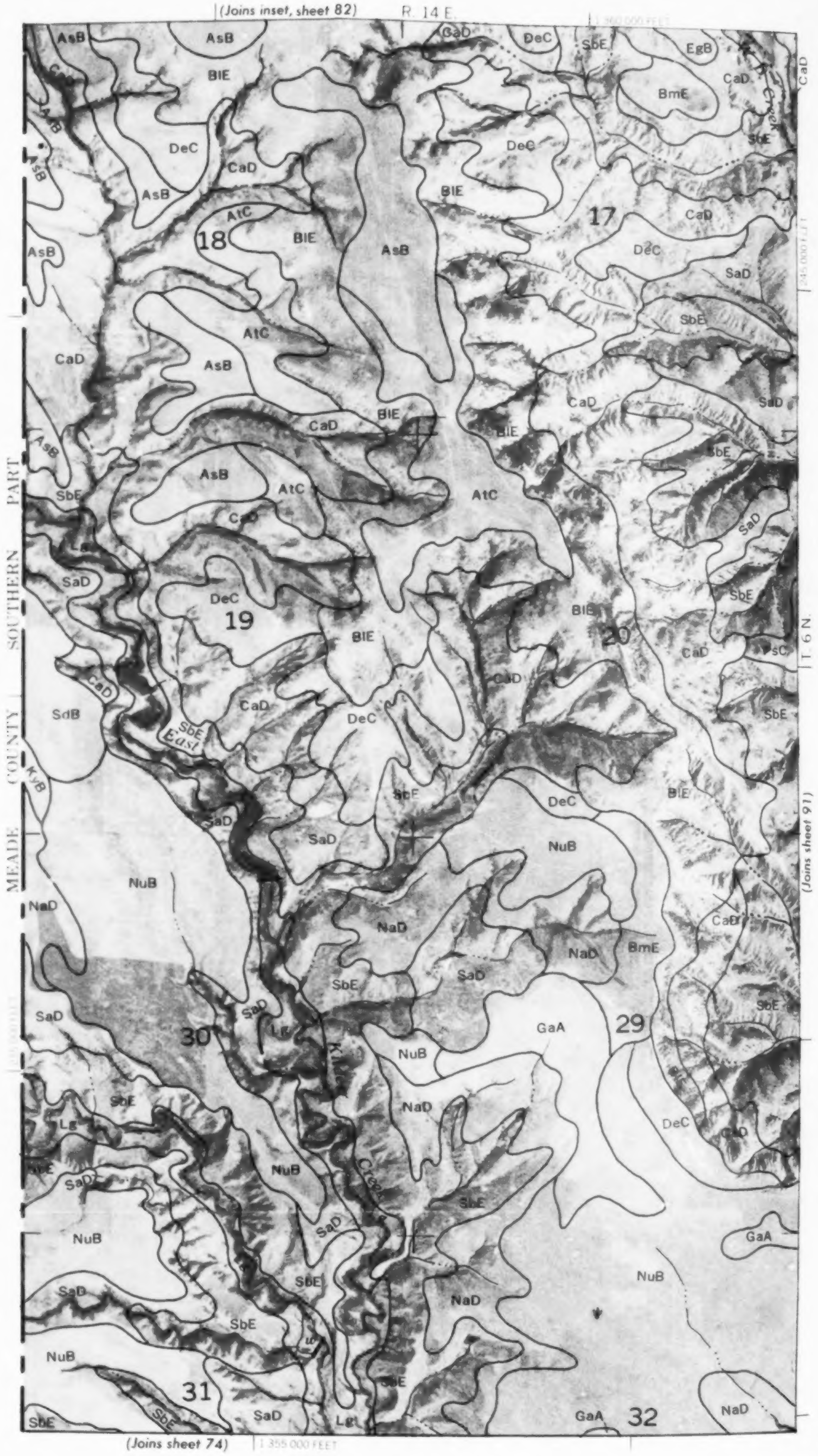
MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 92


N
2 Miles
10 000 Feet
1
5 000
0
0
Scale 1:24 000
½
1000
2000
3000
4000
5000
(Joins sheet 88)
(Joins sheet 91)
(Joins sheet 93)
R. 15 E.
R. 16 E.
1 395 000 FEET
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
32
33
34
CaD
SbE
SaD
PsC
Lg
SdA
NuB
PeB
PeC
Ld
KyB
Bb
Gc
Pine
Creek
Tepee
Second
Bull
Creek
RIVER
PENNINGTON
COUNTY

MEADE COUNTY, SOUTH DAKOTA, NORTHERN PART — SHEET NUMBER 93


(Joins sheet 89)
R. 16 E. | R. 17 E.
1 425 000 FEET
T. 6 N.
(Joins sheet 92)
(Joins inset, sheet 73)
Mud Draw
CHEYENNE RIVER
PENNINGTON COUNTY
PENNINGTON COUNTY
N
Scale 1:24 000
2 Miles
10000 Feet
5000
0
1000
2000
3000
4000
5000
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
32
33
34
35
36
SbE
SaD
CaD
DeC
SdB
BmE
NuB
KyB
GaA
NuA
He
SdA
NaD
Gc
BIE
PsC
PeC
Ld
Bb
Sa


N
2 Miles
10 000 Feet
1
5000
Scale 1:24 000
0
0
1000
2000
3000
4000
5000
(Joins sheet 87)
465 000 FEET
245 000 FEET
(Joins sheet 93)
230 000 FEET
1 450 000 FEET
CHEYENNE RIVER
CHEYENNE RIVER
PENNINGTON COUNTY
Green Draw
15
16
17
18
19
20
21
29
30
31
SdB
NuA
He
GaA
SaD
NaD
PsC
PeC
KyB
Gc
Bb
Ld
Lg
SbE


(Joins inset, sheet 82)
R. 14 E.
1 360 000 FEET
245 000 FEET
T. 6 N.
(Joins sheet 91)
(Joins sheet 74)
1 355 000 FEET
MEADE COUNTY SOUTHERN PART
East
Elk Creek
17
18
19
20
29
30
31
32
AsB
BlE
CaD
DeC
AtC
SbE
SaD
SdB
KyB
NaD
NuB
GaA
BmE
EgB
PsC
Lg